Manual Revision Situation

Revision Date	Revision Level	Description
2012-07-27	1	HGO Data Post Processing Software Package Manual

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CHAPTER

1

Installation and Uninstall

Introduction:

- Software component
- Installation
- Uninstall

Software component

The whole software contains a CD and an operation instruction.

The CD: Contains all the installation procedure.

The instruction: Introduce the operation of the software.

Installation

HGO software can be installed directly from the CD or the hard disk. It needs at least 32M internal storage and 200M hare disk. This software can be operated in the environment below:

- ✧ Microsoft ® Windows 95, 97, 98,SE, ME
- ✧ Microsoft ® Windows NT Service Pack 4 and the latter version
- ✧ Microsoft ® Windows 2000/XP
- ✧ Microsoft ® Windows7
- ✧ Microsoft .Net Frameworks 2.0

Installation steps:

Run the program "HGO.msi" which in the installation directory.

Figure 1-1

Click ***Next***:

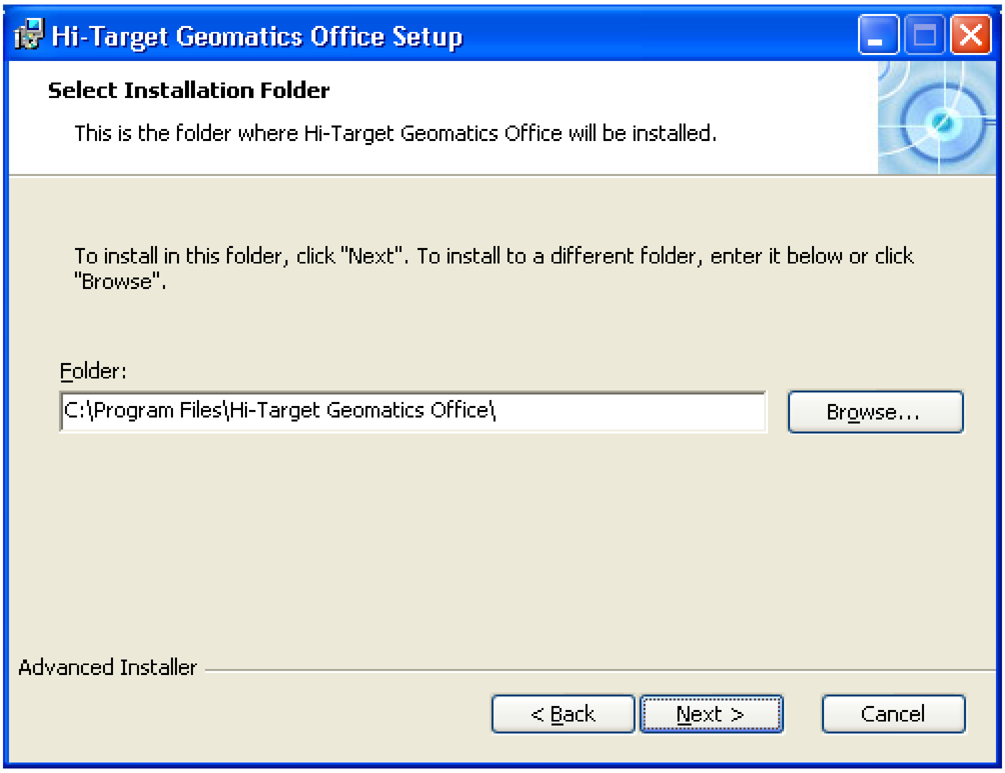


Figure 1-2

Choose an installation path and then click ***Next*****:**

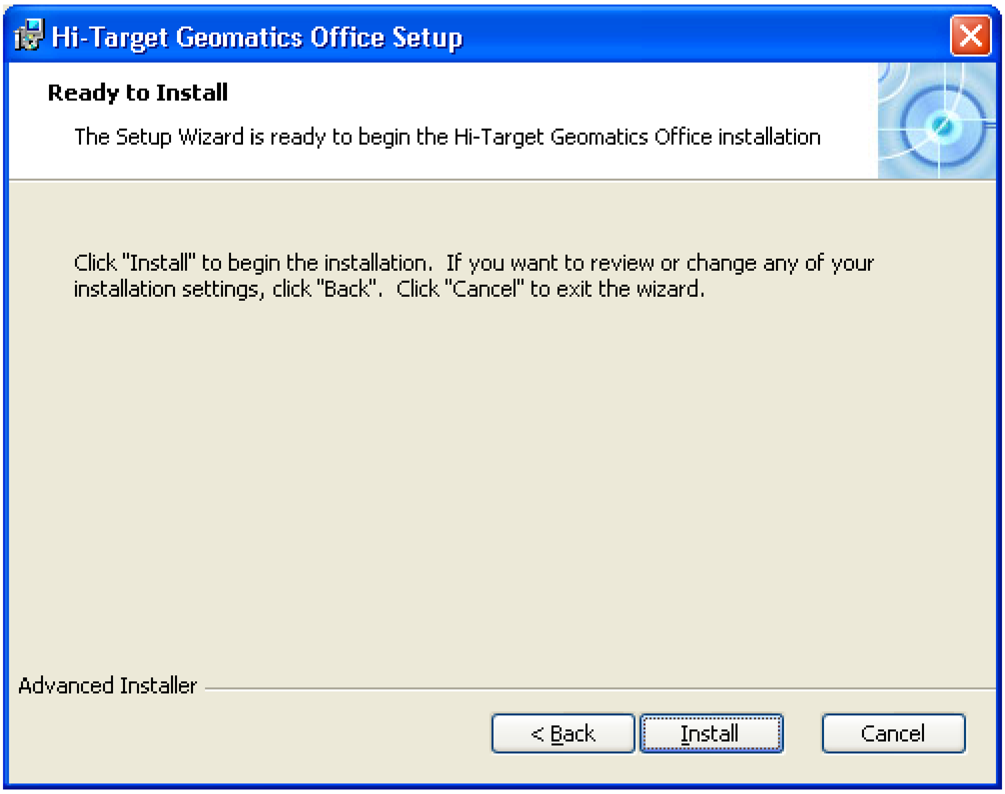


Figure 1-3

Click ***Install***:

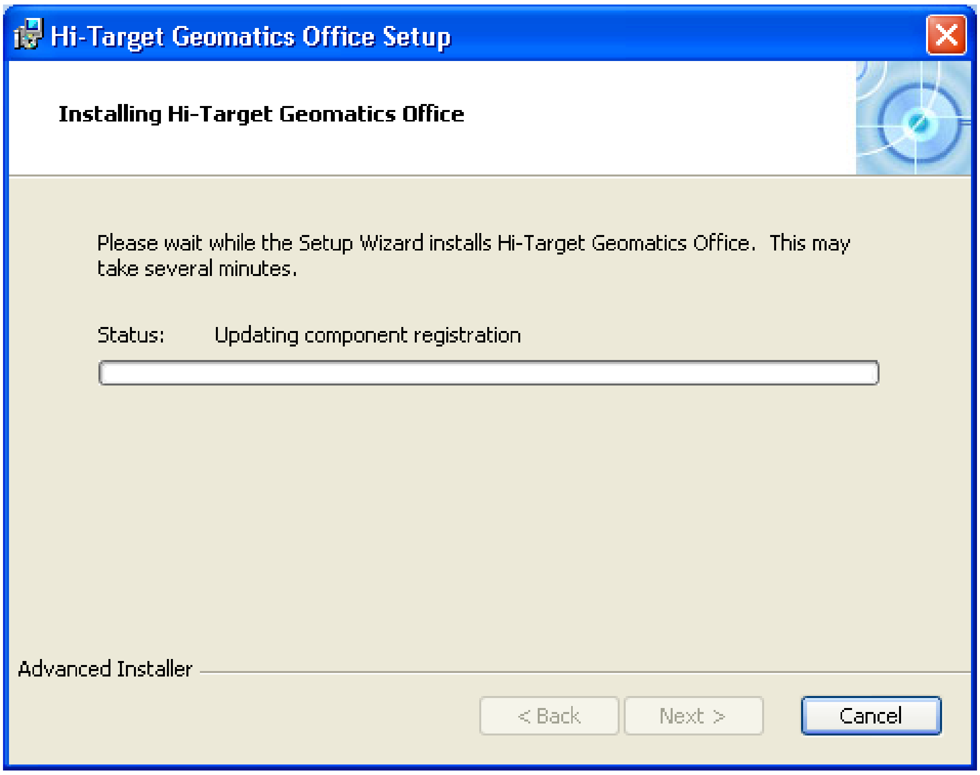


Figure 1-4

Wait until the entire program is installed successfully, then you will see the interface below:

Figure 1-5

There will be a ***Hi-Target Geomatics Office*** file generated automatically in the ***Start*** menu, and this file contains several icons (look at the picture below).

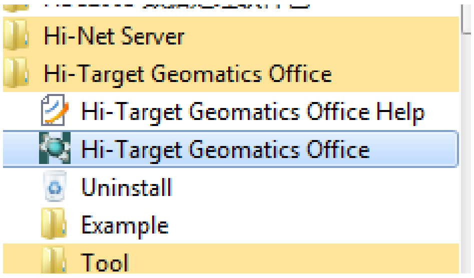


Figure 1-6

Uninstall

There are two ways to uninstall the installed software:

1. Just Select Start\Program\HI-Target Geomatics Office\Uninstall

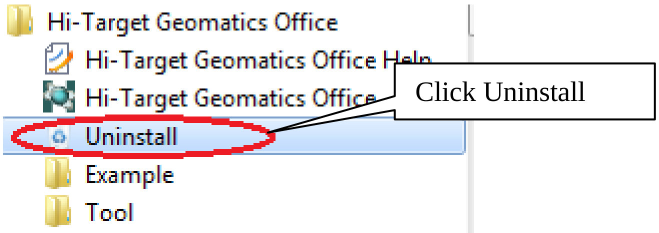


Figure 1-7

2. Select "Start\Setting\Control Panel", chose ***Control Panel***, then ***Add/Remove Programs***, the "Add/Remove Programs" Properties dialog appears. Click on **Add/Remove** get a pop-up window as figure 1-8.

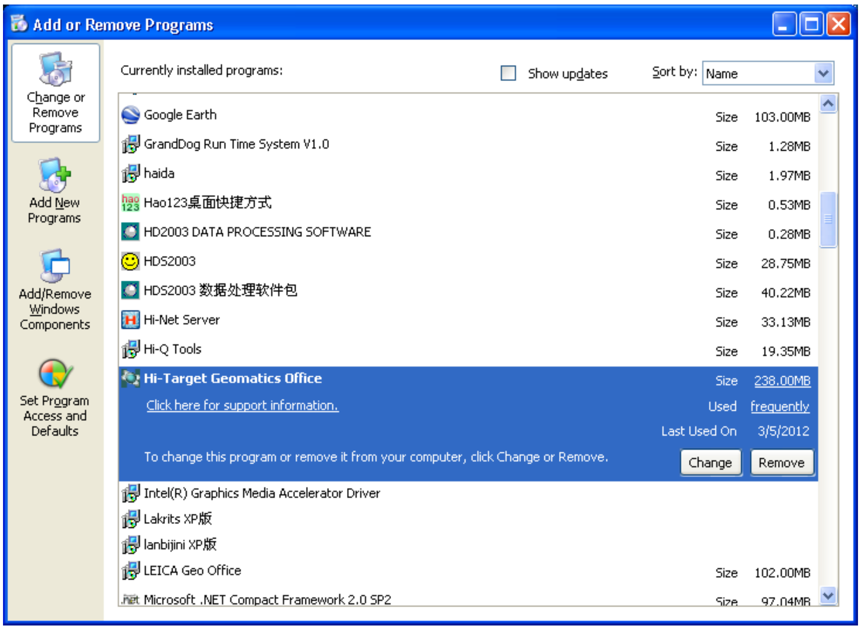

Add or Remove Programs
Change or Remove Programs
Add New Programs
Add/Remove Windows Components
Set Program Access and Defaults
Currently installed programs:
Show updates
Sort by: Name
Google Earth Size 103.00MB
GrandDog Run Time System V1.0 Size 1.28MB
haida Size 1.97MB
Hao123桌面快捷方式 Size 0.53MB
HD2003 DATA PROCESSING SOFTWARE Size 0.28MB
HDS2003 Size 28.75MB
HDS2003 数据处理软件包 Size 40.22MB
Hi-Net Server Size 33.13MB
Hi-Q Tools Size 19.35MB
Hi-Target Geomatics Office Size 238.00MB
Click here for support information.
Used frequently
Last Used On 3/5/2012
To change this program or remove it from your computer, click Change or Remove.
Change
Remove
Intel(R) Graphics Media Accelerator Driver
Lakrits XP版
lanbijini XP版
LEICA Geo Office Size 102.00MB
Microsoft .NET Compact Framework 2.0 SP2 Size 97.04MB

Figure 1-8

CHAPTER

2

Quick Start Guide

Introduction:

- Static GPS Data Processing
- Dynamic Route Processing

In this chapter, we will explain the general procedure via HGO software to resolve the data of static, dynamic. You can find details or advance usage in the following chapters. This chapter helps you to complete data processing rapidly.

Static GPS Data Processing

Create a new project

Run HGO software, click button in the navigation field to create a new project (Figure 2-1). If necessary, set the project name and route which folder store the project files. Otherwise, the files will be stored in the installation folder (Figure 2-2).Click ***OK*** button to finish the project creation.

Figure 2-1

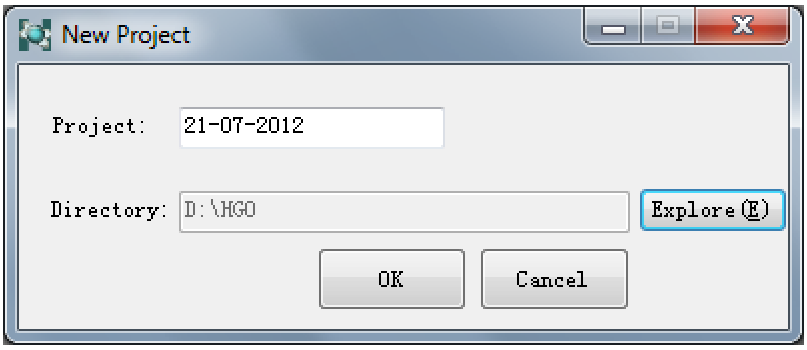


Figure 2-2

Set Property of the Project

Follow the wizard or click on button in the navigation field, the Project Properties dialog appears as Figure 2-3 .You can set the detail info of the project. Generally, you need to set the tolerance item.

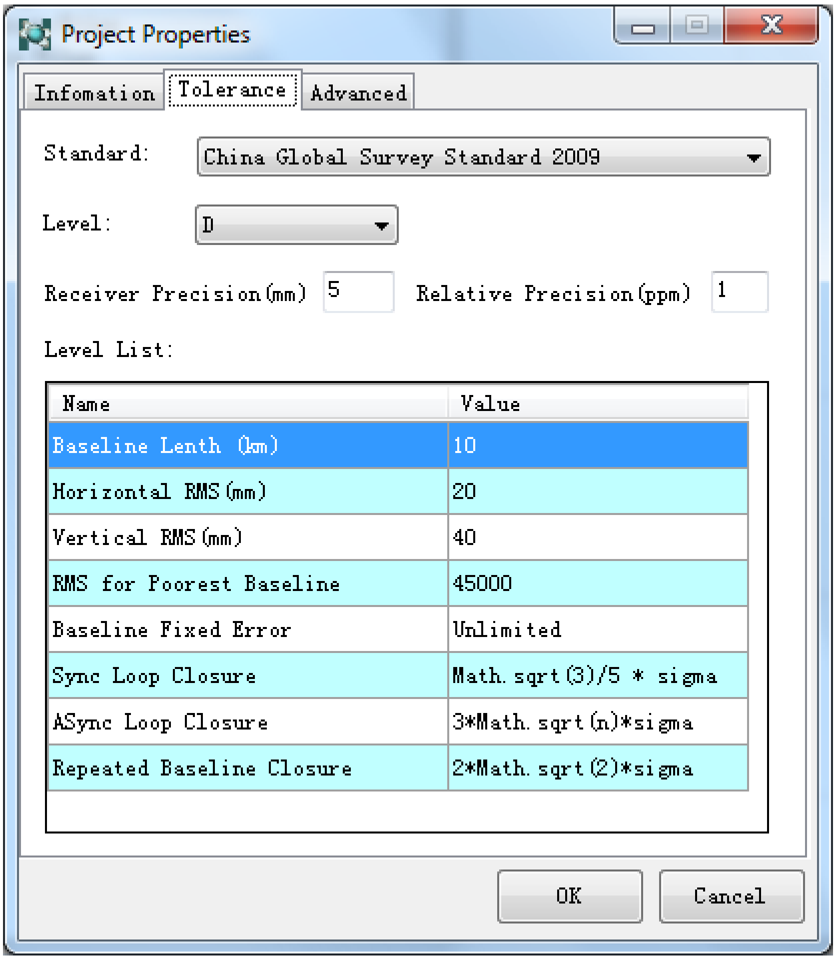


Figure 2-3

Set up Coordinate System

It is necessary to set up the coordinate system parameters for a new project. Click on button in the navigation field, the following dialog appears as Figure 2-4. Generally, setting coordinates just need to set **Ellipsoid**, **Projection** and **Convertion** item. The details of coordinate parameter setting you can find in the following chapter.

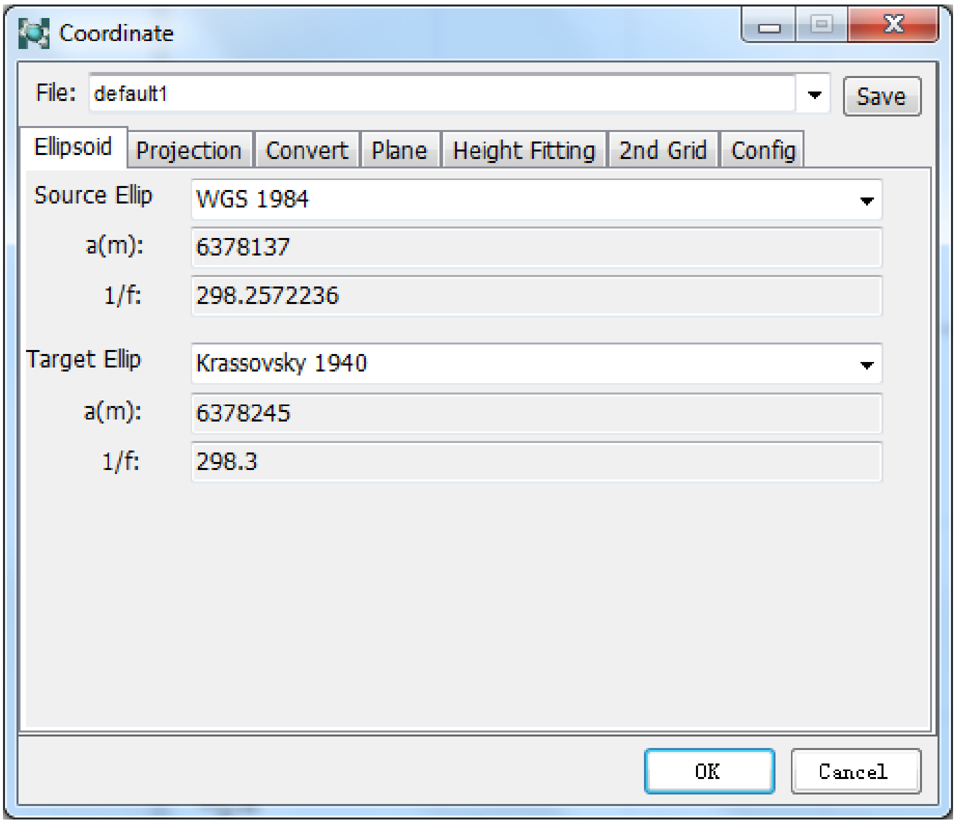


Figure 2-4

Import Static Data

Once you have set up your HGO software project, you can import data into it.

Chose Import Files item in the navigation field, we can load on GPS data observation files (Figure 2-5) . Select static or auto mode in the dialog, click on Select Files button or double-click to enter the file selection interface, as Figure 2-6:

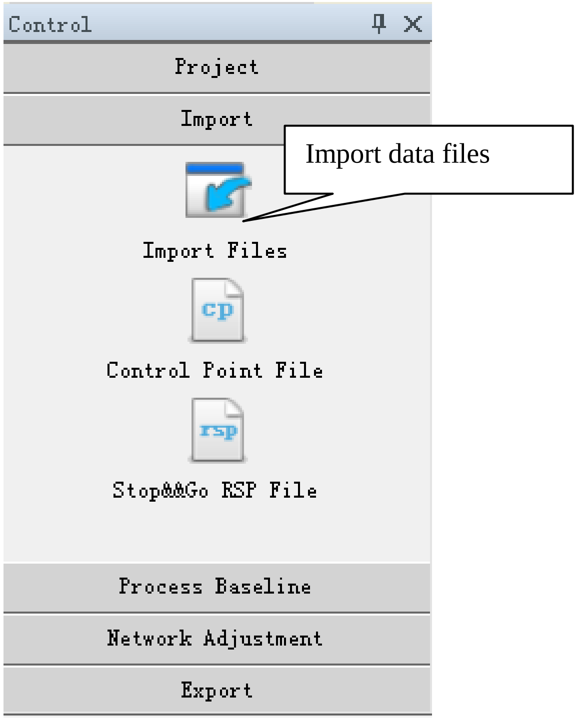


Figure 2-5

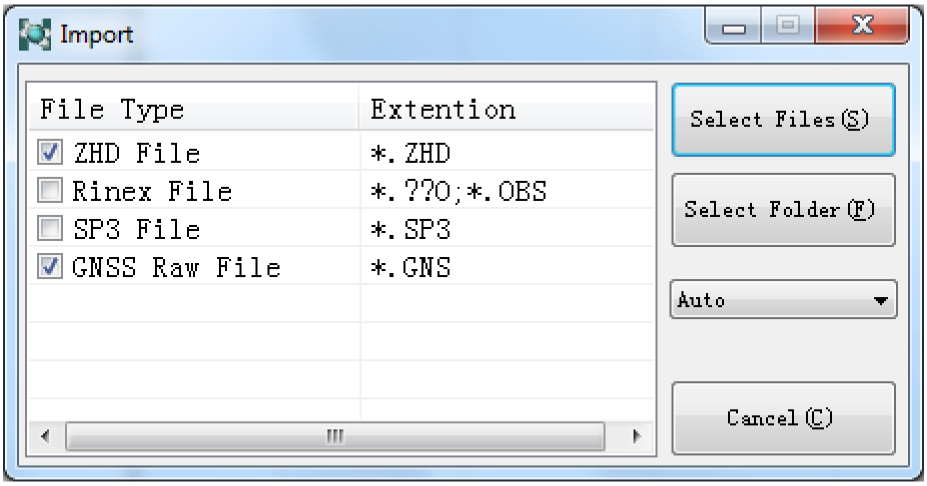


Figure 2-6

Chose static files, as Figure2-7, you can press ***CTRL*** or ***SHIFT*** key to select a few items, click on ***Open***, import the data(Figure 2-8):

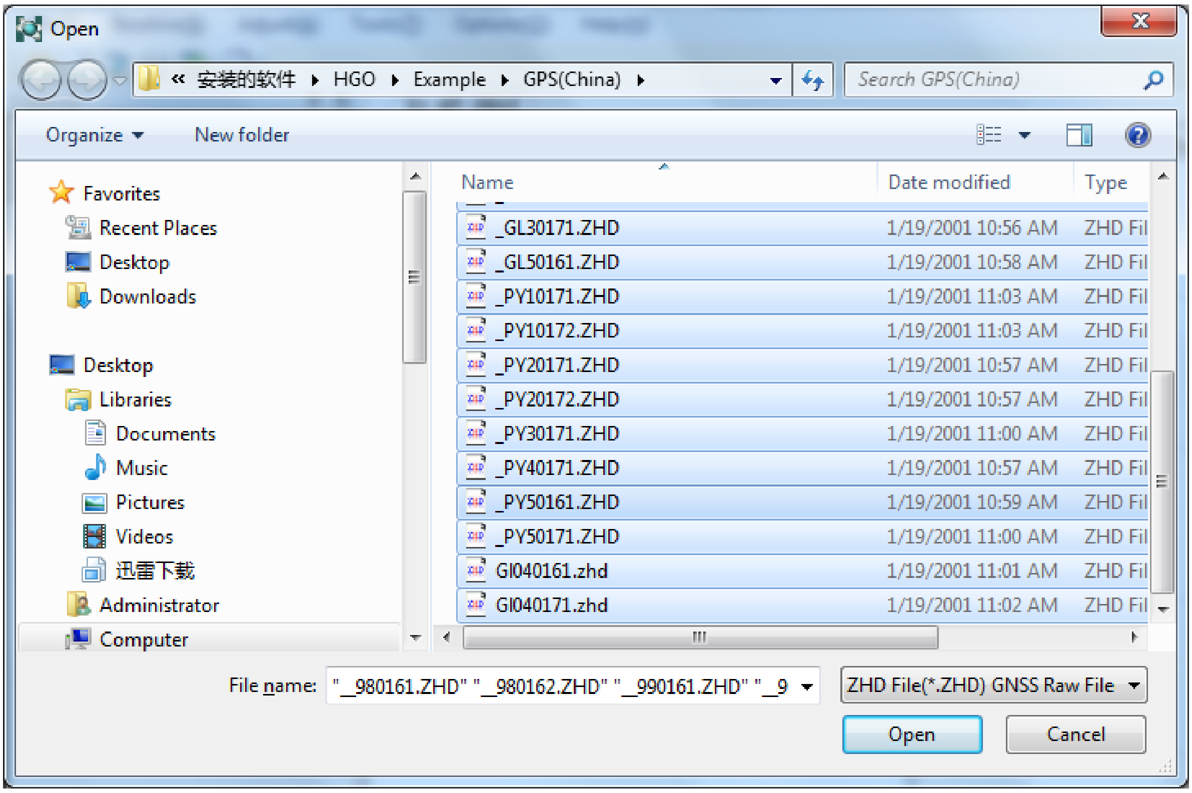


Figure 2-7

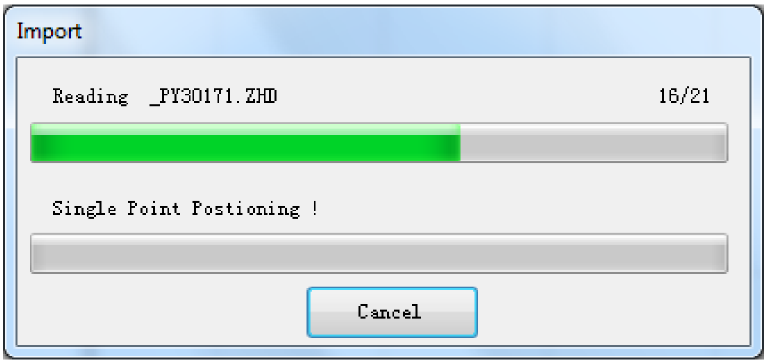


Figure 2-8

After importing the data, HGO software can automatically generate baselines, repeat baseline, sync loop, asynchronous loop and so on (Figure 2-9).

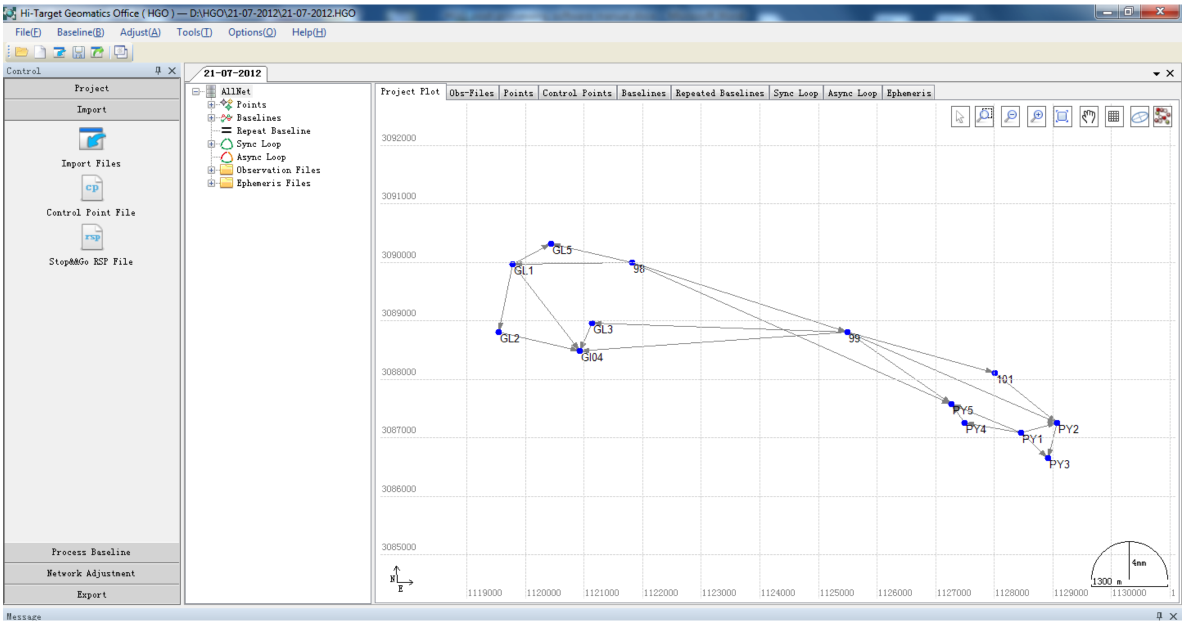


Figure 2-9

Edit Files Information

After loaded on all the data, system will display all observation files. Chose the tree type directory of Observation files and switch the tab to ***Obs-files*** in the work field, and then you can view the list of all files (Figure 2-10). Double click on one, enter the editor window. Make sure the height antenna, the type of receiver and antenna are right (Figure 2-11).Do this for all files.

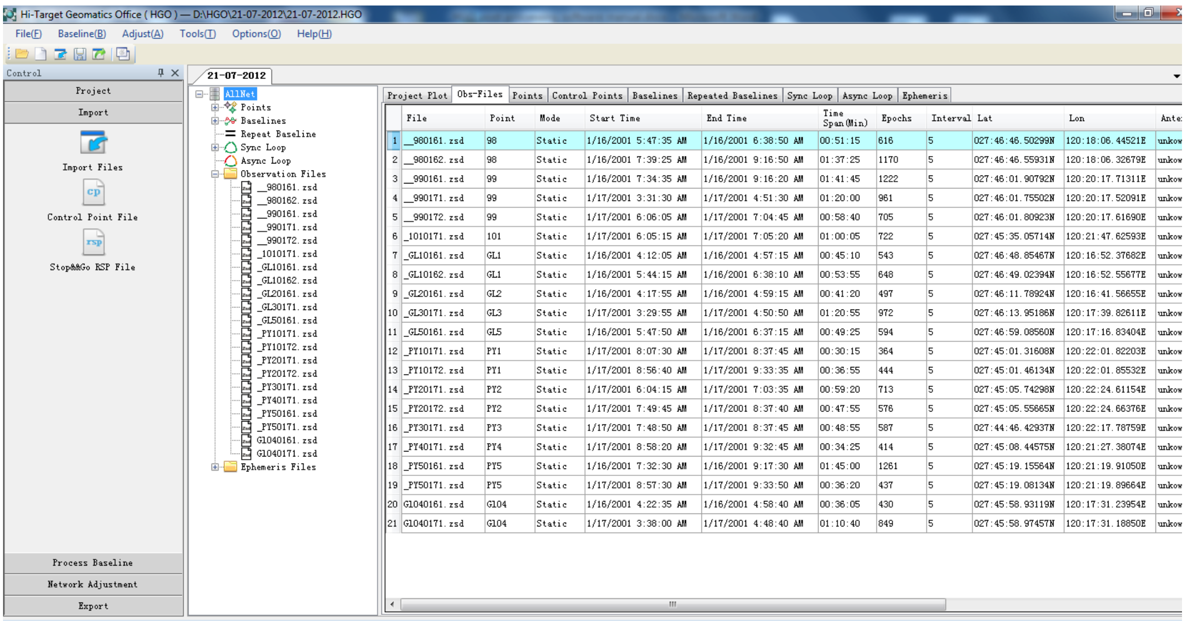


Figure 2-10

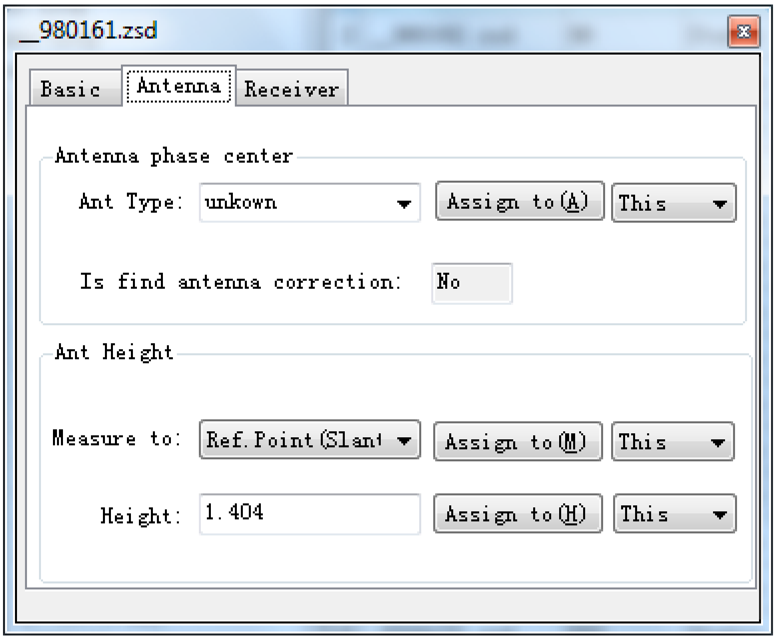


Figure 2-11

Baseline Processing

After loaded on all the data, system shows all the GPS baseline vectors and the plan view shows all the information about the GPS network.

Then you can process the baseline, click ***Process Baseline*** -> button in the navigation field to process baselines, the system will process all the baselines according to the default settings (Figure 2-12)

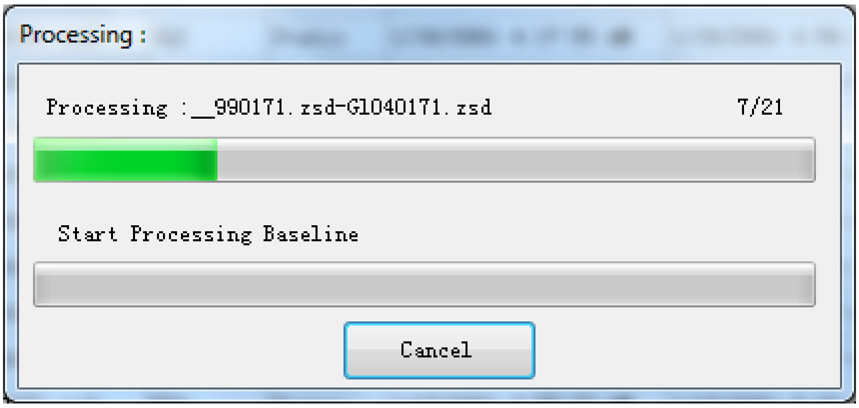


Figure 2-12

During the processing, program shows the schedule of the baselines as Figure 2-13, we can find the processing information about each baseline processing in the list of ***Baselines***.

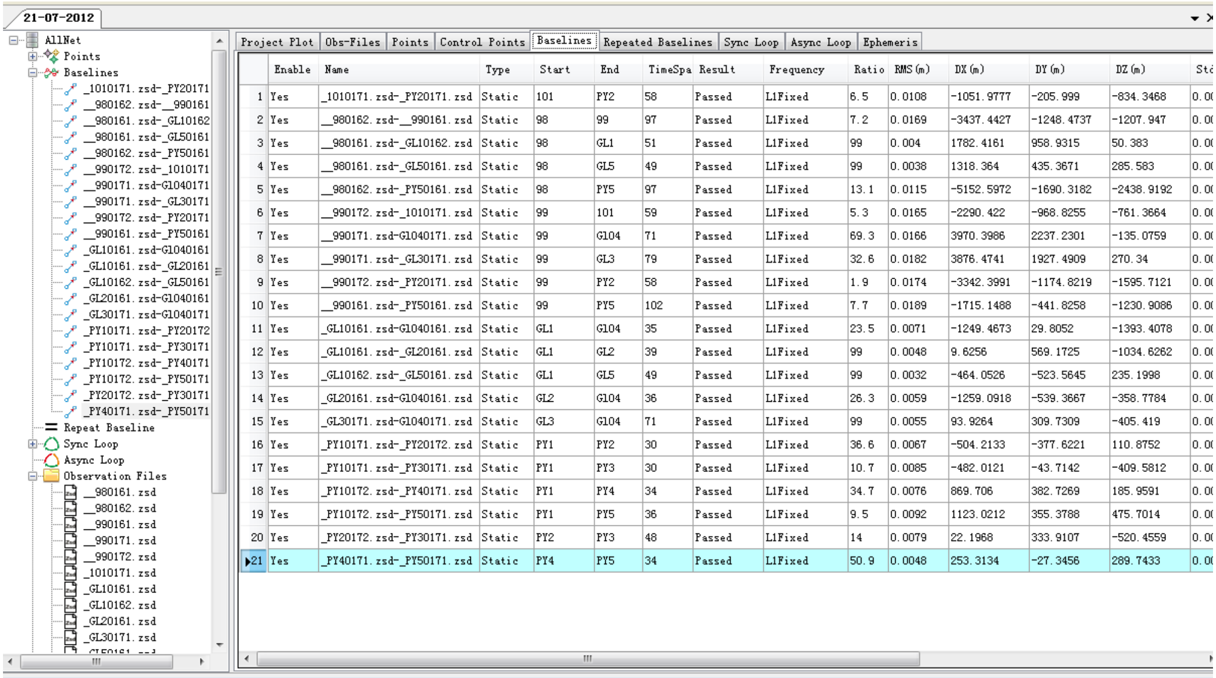


Figure 2-13

The time of baseline solution depends on the number of the baseline, the time of the observation, the baseline processing setting, and the rate of the computer. Completing all the baseline, the baseline solution result displays in the baseline list window. The color of the previous unsolved baseline in the map changes from light to dark green. (Figure2-14)

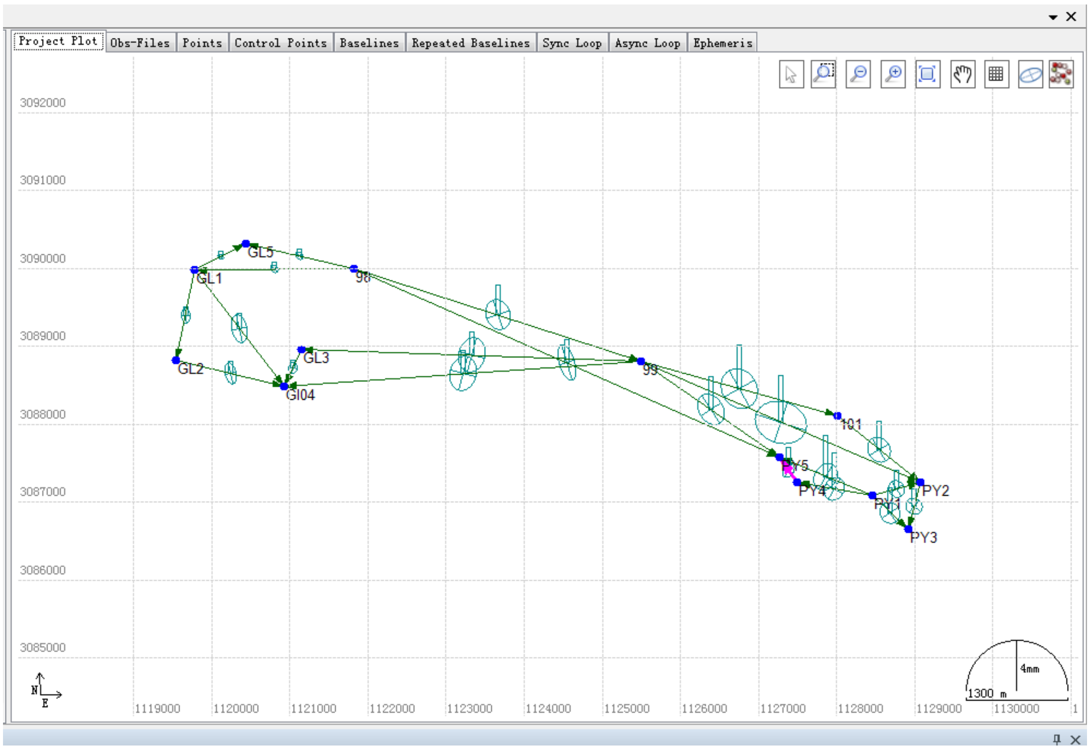


Figure 2-14

Adjustment Setting

After the baseline processing, it is need to check the adjustment result. But for this simple section, we suppose all the baselines are good. Generally, if the observation condition is good, we can process all the baselines once successfully.

It is needed to delete part of a baseline, according to the quality of synchronous observation after the solution. Here we will not explain it, too.

Now we begin to prepare the network adjustment.

First we should set some points as control points. Switch work field to ***Points*** tab, select one site and right-click on the selected site. Then chose ***Set as Control Point*** item ,the selected point will be add to the list of control points automatically(Figure 2-15).

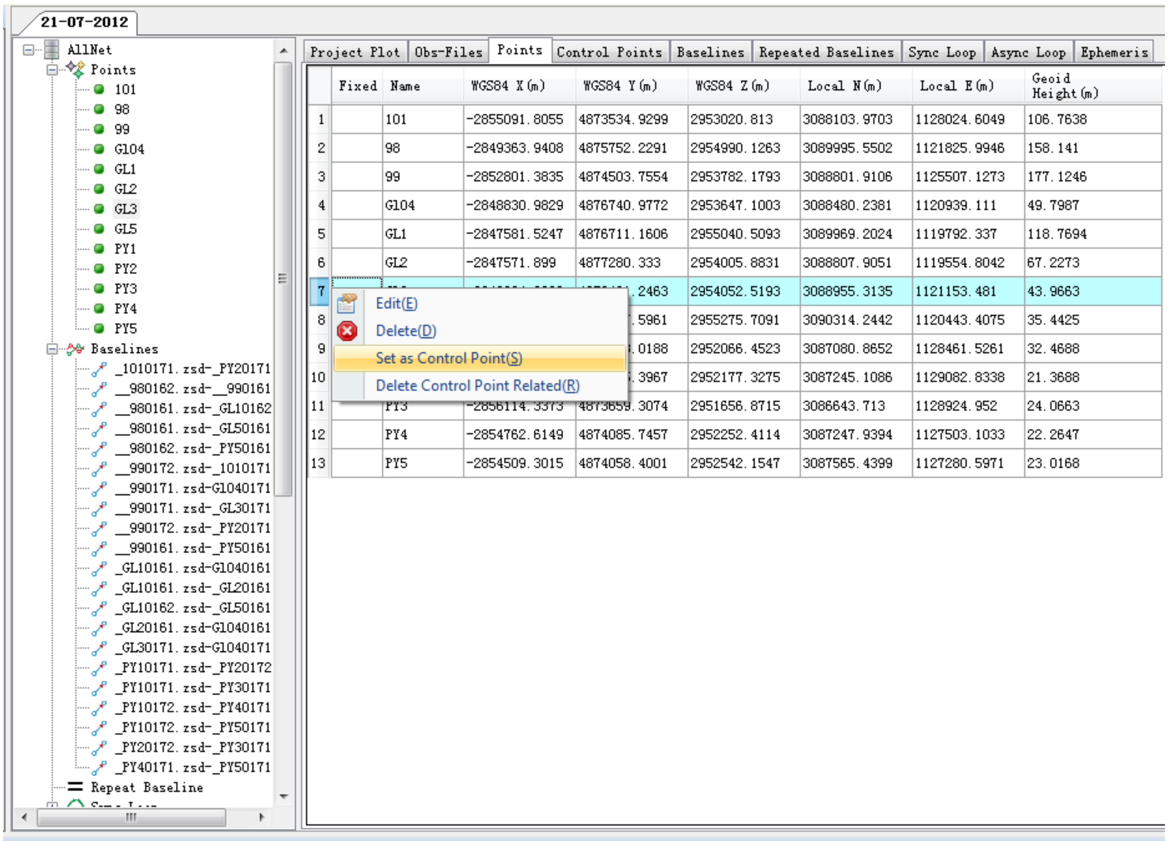
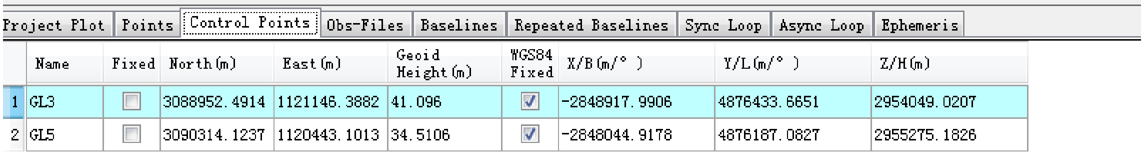


Figure 2-15

Switch work field to ***Points*** tab, you will find this point which you set as control point (Figure 2-16).Double click on one point name, you can edit these points as Figure 2-17.Do this for all control points.



	Name	Fixed	North(m)	East(m)	Geoid Height(m)	WGS84 Fixed	X/B(m/°)	Y/L(m/°)	Z/H(m)
1	GL3	☐	3088952.4914	1121146.3882	41.096	☑	-2848917.9906	4876433.6651	2954049.0207
2	GL5	☐	3090314.1237	1120443.1013	34.5106	☑	-2848044.9178	4876187.0827	2955275.1826

Figure 2-16

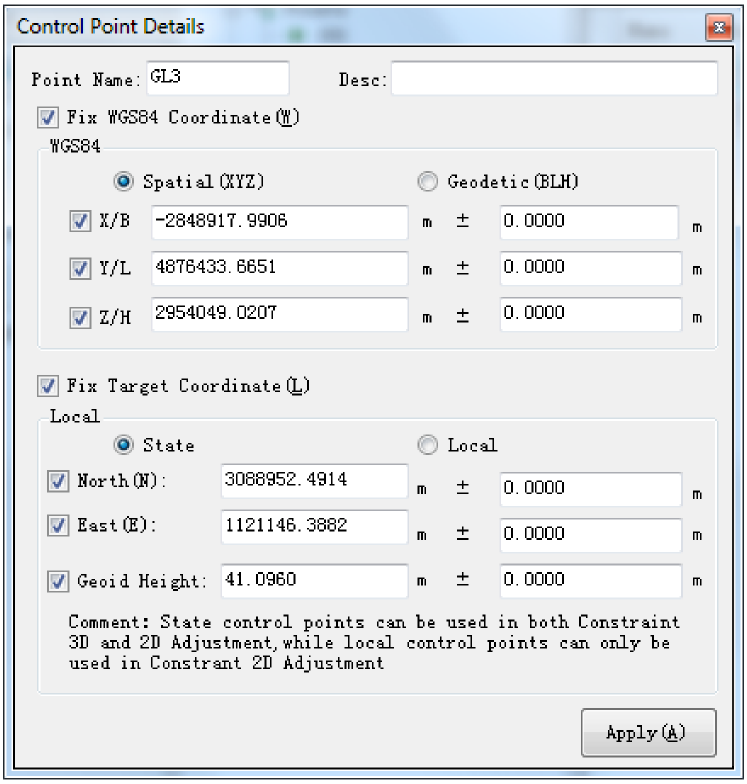


Figure 2-17

Network Adjustment

Click on button in the navigation field in the navigation field, enter the adjustment setting window(Figure 2-18).After setting adjustment options, you can choose Adjust item , then Network Adjustment tool window appears as Figure 2-18.

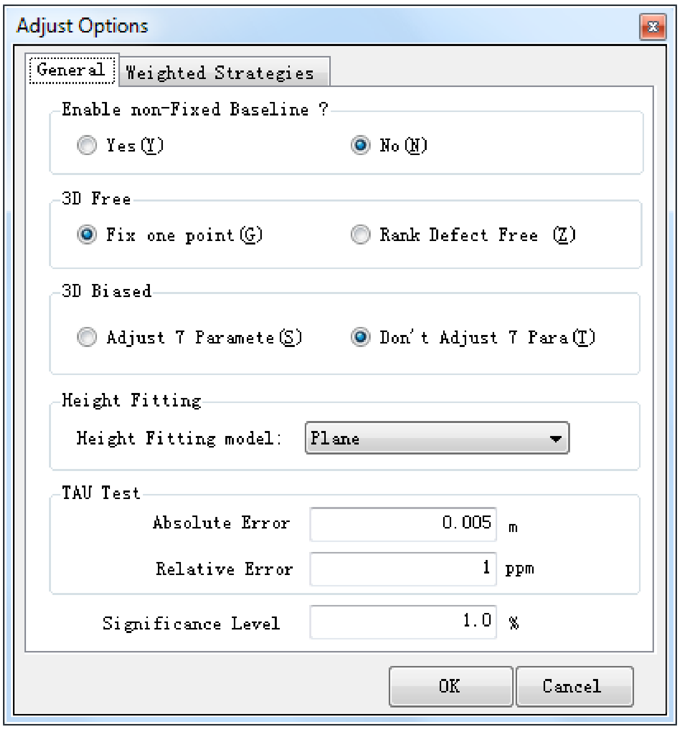


Figure 2-18

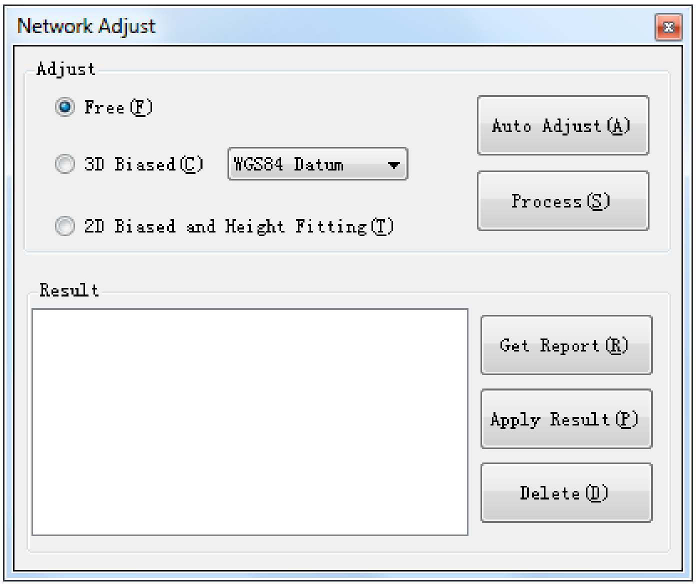


Figure 2-19

Click on ***Auto Adjust*** button, it will do free 3D adjustment, constraint 3D adjustment under WGS84 ellipsoid, constraint 3D adjustment and 2D adjustment under local ellipsoid according to the settings above. It also can generate adjustment result list.

Report

Click on button in the navigation field, you can set output items which you want to view in the adjustment report and the format of adjustment report (Figure 2-20).

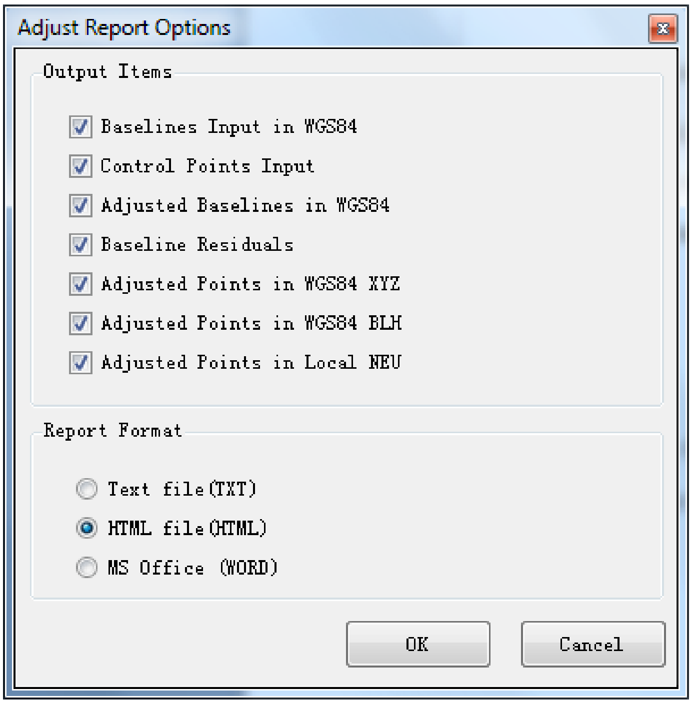
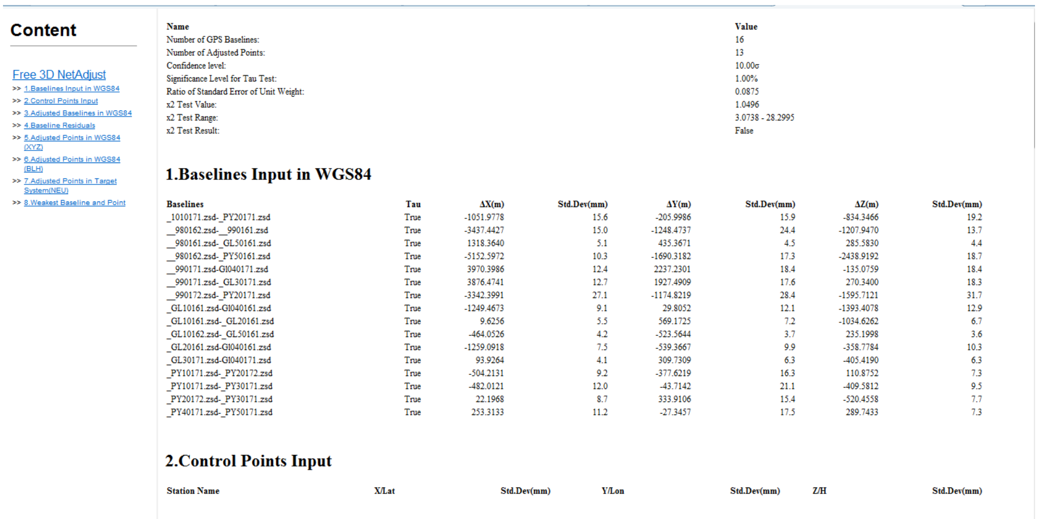


Figure 2-20

Then chose , select one result which you want to view in the adjustment result lists, click on Get Report button. It will generate adjustment report as Figure 2-21.The context of report ,you can find in following chapter.



Content

Free 3D NetAdjust
>> 1.Baselines Input in WGS84
>> 2.Control Points Input
>> 3.Adjusted Baselines in WGS84
>> 4.Baseline Residuals
>> 5.Adjusted Points in WGS84 (XYZ)
>> 6.Adjusted Points in WGS84 (BLH)
>> 7.Adjusted Points in Target System(NEU)
>> 8.Weakest Baseline and Point

Name	Value
Number of GPS Baselines:	16
Number of Adjusted Points:	13
Confidence level:	10.00σ
Significance Level for Tau Test:	1.00%
Ratio of Standard Error of Unit Weight:	0.0875
x2 Test Value:	1.0496
x2 Test Range:	3.0738 - 28.2995
x2 Test Result:	False

1.Baselines Input in WGS84

Baselines	Tau	ΔX(m)	Std.Dev(mm)	ΔY(m)	Std.Dev(mm)	ΔZ(m)	Std.Dev(mm)
_1010171.zsd-_PY20171.zsd	True	-1051.9778	15.6	-205.9986	15.9	-834.3466	19.2
__980162.zsd-__990161.zsd	True	-3437.4427	15.0	-1248.4737	24.4	-1207.9470	13.7
__980161.zsd-_GL50161.zsd	True	1318.3640	5.1	435.3671	4.5	285.5830	4.4
__980162.zsd-_PY50161.zsd	True	-5152.5972	10.3	-1690.3182	17.3	-2438.9192	18.7
__990171.zsd-GI040171.zsd	True	3970.3986	12.4	2237.2301	18.4	-135.0759	18.4
__990171.zsd-_GL30171.zsd	True	3876.4741	12.7	1927.4909	17.6	270.3400	18.3
__990172.zsd-_PY20171.zsd	True	-3342.3991	27.1	-1174.8219	28.4	-1595.7121	31.7
_GL10161.zsd-GI040161.zsd	True	-1249.4673	9.1	29.8052	12.1	-1393.4078	12.9
_GL10161.zsd-_GL20161.zsd	True	9.6256	5.5	569.1725	7.2	-1034.6262	6.7
_GL10162.zsd-_GL50161.zsd	True	-464.0526	4.2	-523.5644	3.7	235.1998	3.6
_GL20161.zsd-GI040161.zsd	True	-1259.0918	7.5	-539.3667	9.9	-358.7784	10.3
_GL30171.zsd-GI040171.zsd	True	93.9264	4.1	309.7309	6.3	-405.4190	6.3
_PY10171.zsd-_PY20172.zsd	True	-504.2131	9.2	-377.6219	16.3	110.8752	7.3
_PY10171.zsd-_PY30171.zsd	True	-482.0121	12.0	-43.7142	21.1	-409.5812	9.5
_PY20172.zsd-_PY30171.zsd	True	22.1968	8.7	333.9106	15.4	-520.4558	7.7
_PY40171.zsd-_PY50171.zsd	True	253.3133	11.2	-27.3457	17.5	289.7433	7.3

2.Control Points Input

Station Name	X/Lat	Std.Dev(mm)	Y/Lon	Std.Dev(mm)	Z/H	Std.Dev(mm)

Figure 2-21

At this time, the processing is over. You can chose  in the navigation field to export the solution result.

Next we will introduce how to process dynamic GPS data.

Dynamic Route Processing

Dynamic GPS data processing has three solving mode: RTD, Stop&Go, PPK (Post Process Kinematic).The difference of them can be find in chapter 5.

Import Data

First we create a project as static GPS data processing. Because during the outdoor observation, one dynamic baseline includes two files at least, one is static observation file and another is dynamic observation file, they are defined to be synchronous. When you import the observation data files with dynamic and static mode, make sure which file is static file and dynamic file. Generally, data files exported from rover is dynamic files, from base or CORS is static file. If you import data files by auto mode, you just need to import all observation data files (Figure 2-23).

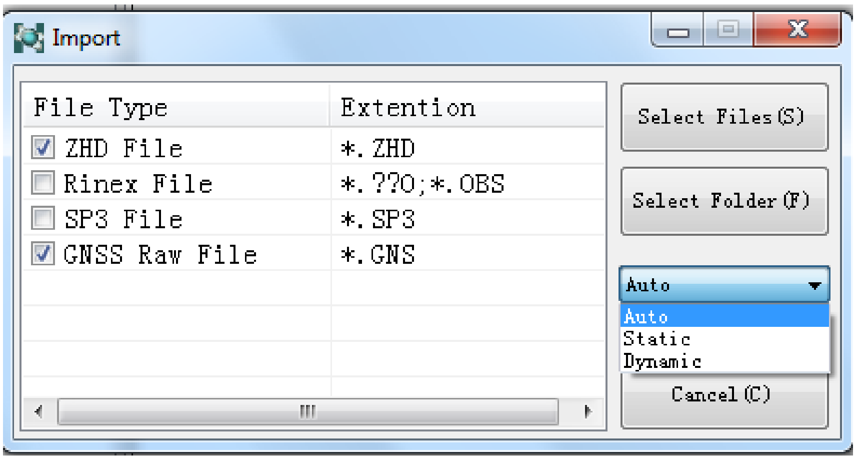


Figure 2-22

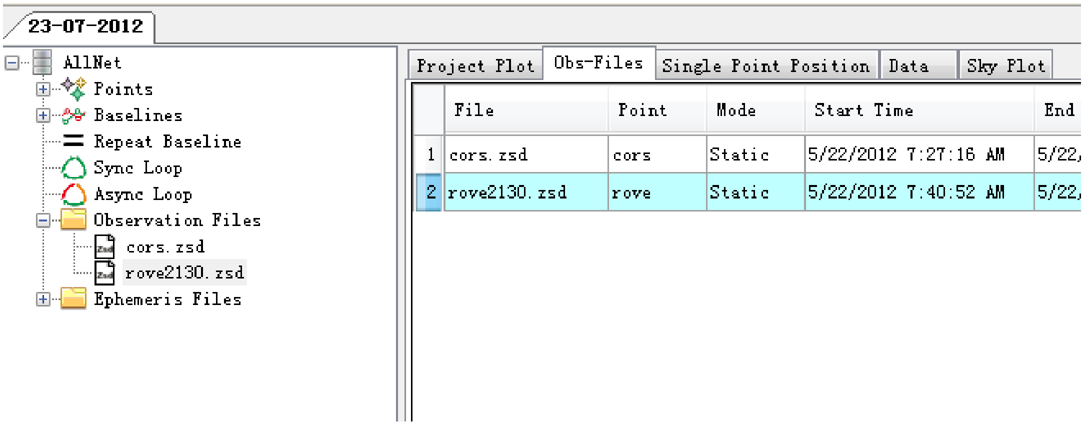


Figure 2-23

Set Property of Observation Files and Points

Set the Mode of Observation Files

If you import data files by auto mode, you need to convert the data file which is exported by rover to dynamic mode. Click ***Switch to Static/Kinematic*** menu in the pop-up menu as Figure 2-24.

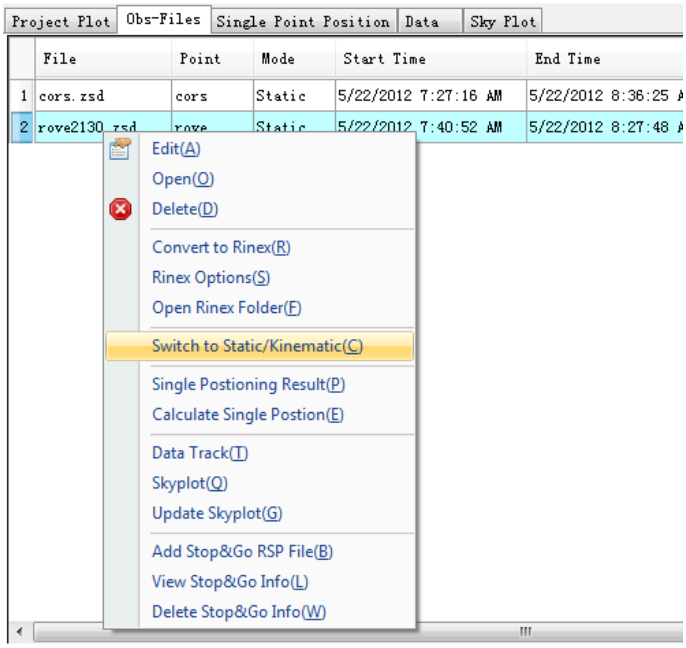


Figure 2-24

Edit the Coordinate of Points

Chose the ***Points*** node of tree list in the left of work field, select the base point (reference station) and double click on it, Station window displays as Figure 2-25.Edit and confirm the coordinate of the station.

Notice: The coordinate of reference station must be accurate, or solving result is not accurate.

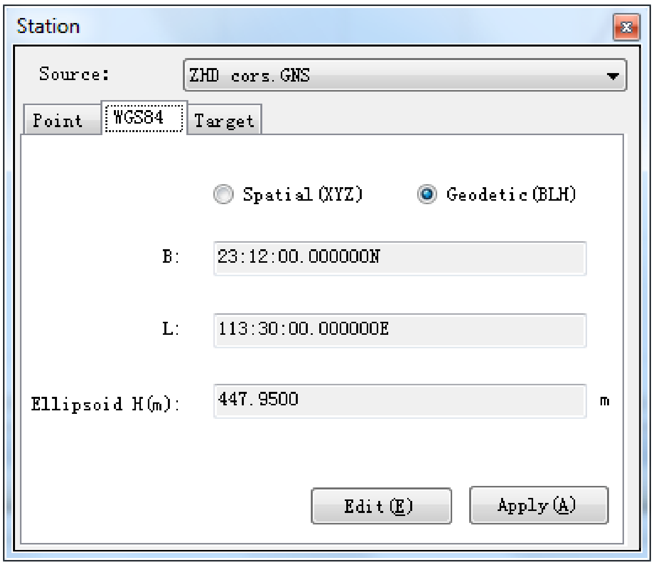


Figure 2-25

Add Stop&Go RSP File

Stop&Go RSP file is a time file which record the start time and end time of a stop stage in field work. If you do stop&go or PPK processing, you can add stop&go RSP file to dynamic observation file. Certainly, if you don't add stop&go RSP file, program will also do processing, in fact, the result is just pure dynamic solution result and you only obtain go stage solution result in the repot. Chose ***Stop&Go RSP File*** menu item in the pop-up menu as Figure 2-26, add corresponding stop&go RSP file.

Notice: Because observation file is divided into stop stage files by RSP file, the correctness of RSP file is very important. Make sure that the observation time of RSP file is consistent with observation files.

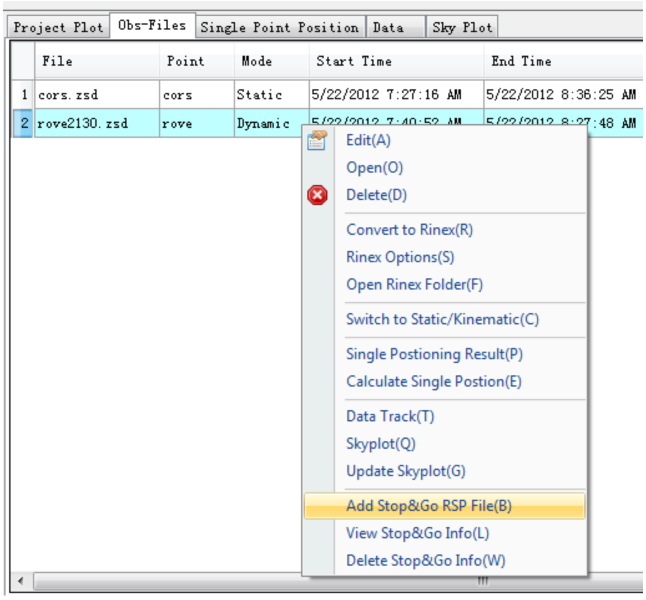


Figure 2-26

Dynamic GPS Data Solution

After the operation of the above, next we will process baselines.

Processing Settings

Chose the ***Baselines*** node in the tree list view, then you can see the detail view switch to ***Baselines*** tab page. Right click on one or more baselines. Chose ***Process Options*** menu item in the pop-up menu (Figure 2-27), enter the following window as Figure 2-28.

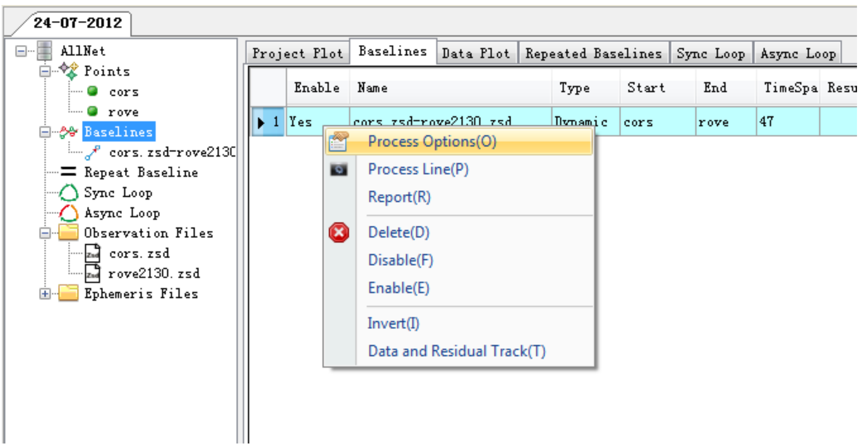


Figure 2-27

Notice: If you do Stop&Go processing, we suggest you setting the minimum epoch to 180s. If the minimum epoch is too small, the integer ambiguity will not be fixed.

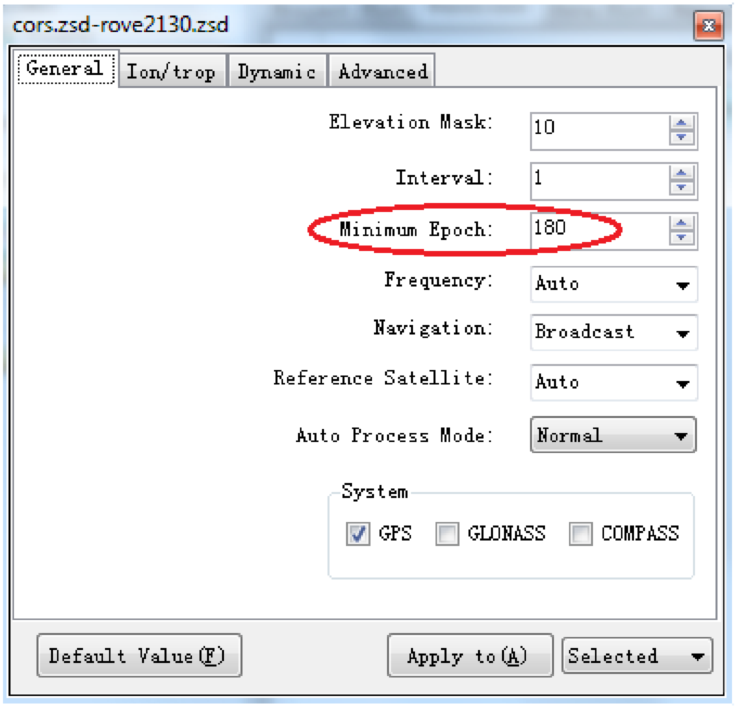


Figure 2-28

Chose Dynamic tab page in the above window, set the mode of procession as Figure 2-29.

After you finish your settings, click on ***Apply to*** button to complete setting and back to work interface.

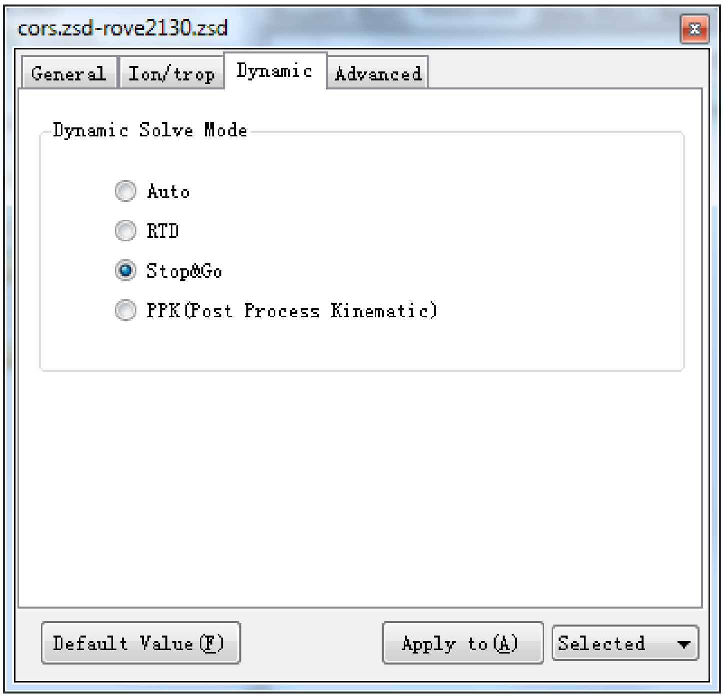


Figure 2-29

Process Baseline

Chose Process Line menu item in the pop-up menu, begin to process the selected baselines. You can see solution status on the process status bar as Figure 2-30.

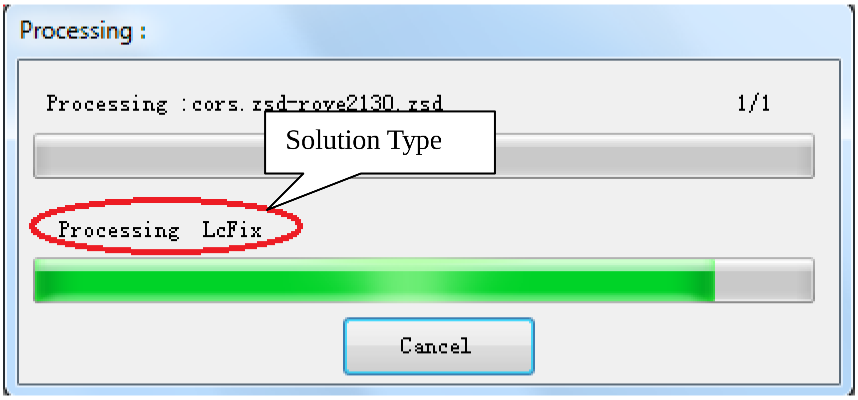


Figure 2-30

After processing, you can view the plan map of dynamic route. The green color represent fixed solution, yellow is float, red is single.

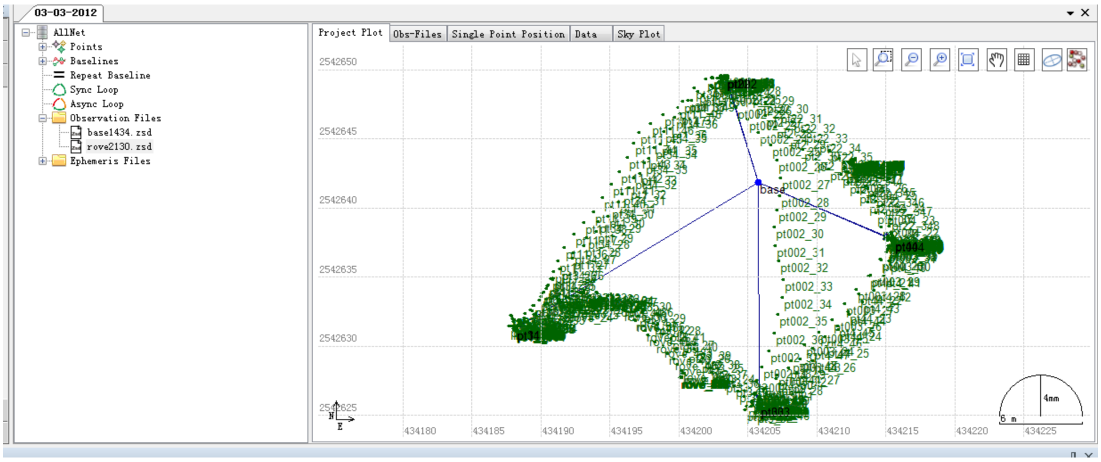


Figure 2-31

Click on button, the map display as the following Figure 2-32.The map just display the stop points.

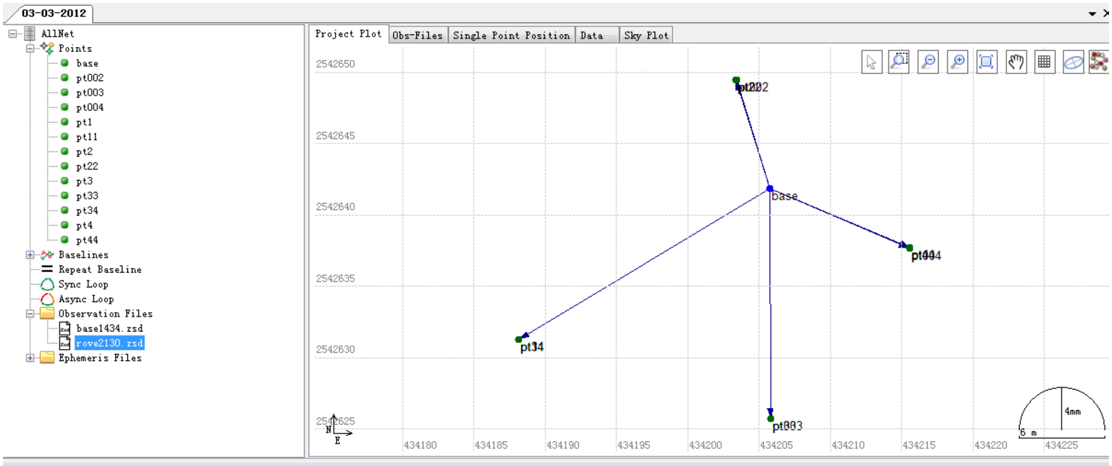
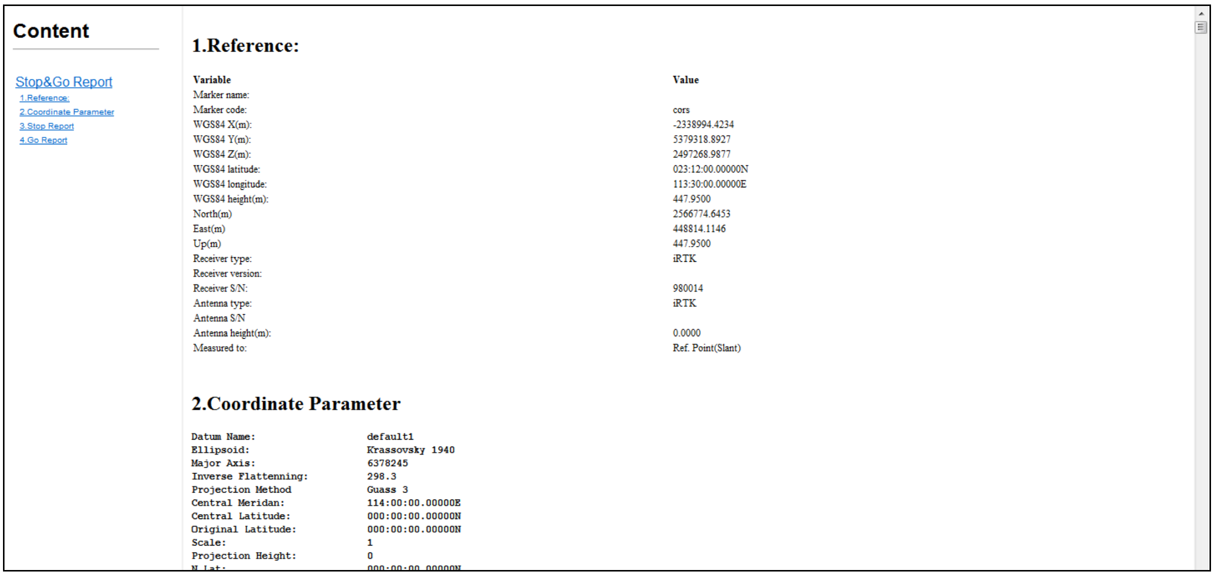


Figure 2-32

Report

Chose Process Line menu item in the pop-up menu to generate the solution result report.



Content

Stop&Go Report
1.Reference:
2.Coordinate Parameter
3.Stop Report
4.Go Report

1.Reference:

Variable	Value
Marker name:	
Marker code:	cors
WGS84 X(m):	-2338994.4234
WGS84 Y(m):	5379318.8927
WGS84 Z(m):	2497268.9877
WGS84 latitude:	023:12:00.00000N
WGS84 longitude:	113:30:00.00000E
WGS84 height(m):	447.9500
North(m)	2566774.6453
East(m)	448814.1146
Up(m)	447.9500
Receiver type:	iRTK
Receiver version:	
Receiver S/N:	980014
Antenna type:	iRTK
Antenna S/N	
Antenna height(m):	0.0000
Measured to:	Ref. Point(Slant)

2.Coordinate Parameter

Datum Name:	default1
Ellipsoid:	Krassovsky 1940
Major Axis:	6378245
Inverse Flattenning:	298.3
Projection Method	Guass 3
Central Meridan:	114:00:00.00000E
Central Latitude:	000:00:00.00000N
Original Latitude:	000:00:00.00000N
Scale:	1
Projection Height:	0
N Lat:	000:00:00.00000N

Figure 2-33

Thus, we process a static baseline control network already. You can chose  in the navigation field to export the solution result.

CHAPTER

3

Program Main Interface

Introduction:

- HGO Main Program
- Menu and Toolbars
- Navigation Field
- Plan View
- Tree List View of Work Field
- Detail View of Work Field

HGO Main Program

Run HI-Target Geometrics office Software Package in the Start menu, or directly run Icon, then it enters the main program. Now you can get the window as Figure 3-1. This window includes Menu bar, Tool bar, Status bar, Navigation field, Message field, Work field and so on.

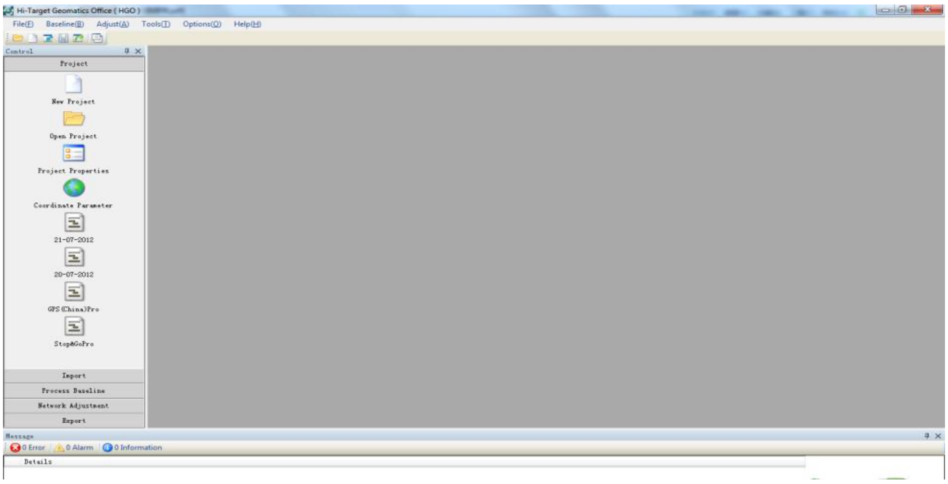


Figure 3-1

Chose file menu or chose a project in the Project Navigation Filed, open a project, if you chose GPS(China) Pro which is a demonstration project, you will find the window as Figure 3-2

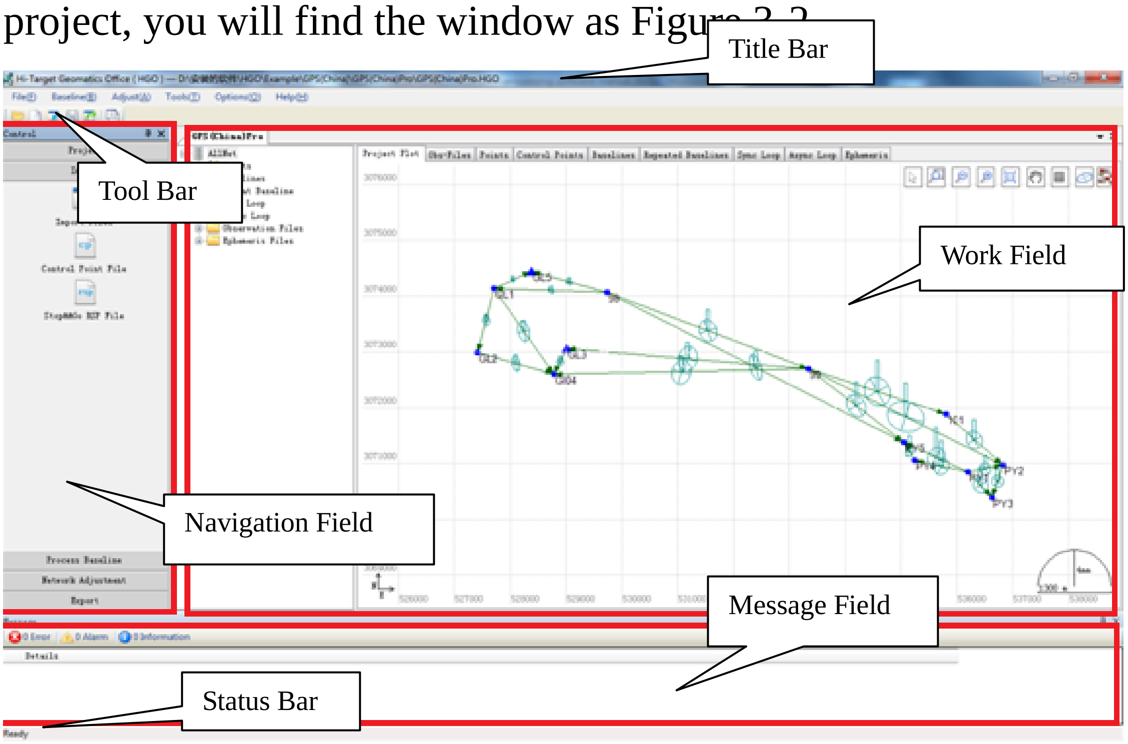


Figure 3-2

According to the design, user interface include fields as following:

Title bar: Title bar can help you quickly determine the type of current application. And you can do a few programs controlling, such as, Maximum, Minimum and Exit program. If you open a project, it will display the project name.

Menu bar: The list menu is an important part of any type window. It supplies many commands to create engineering files, process data, and manage data.

Tool bar: Provide majority common shortcut keys to fast operation.

Status bar: Display a few guides about current operations.

Work field: It is the user's main work field, generally includes every type views related to the project.

Navigation field: Provide common shortcut keys for fast operation.

Message field: Output message of processing.

Next, we explain all the operations to the main program.

Menu and Toolbars

Menu

The main menu of the program is consists of File, Baseline, Adjust, Tools, Options, Help. Every menu item has a window shortcut key. The menu items provide the operation to complete most of the data processing work and cover the main processing steps.

Figure 3-3

Tool Bar

You can achieve a few common operations and accelerate the rate via the Toolbars in the main program. It includes create new project, open project, save project, import data, export data, get default view (Figure 3-4).


Figure 3-4

Navigation Field

The navigation field is a quick entrance of menu bar, you can show or hide it. It is used to make user's operation faster.

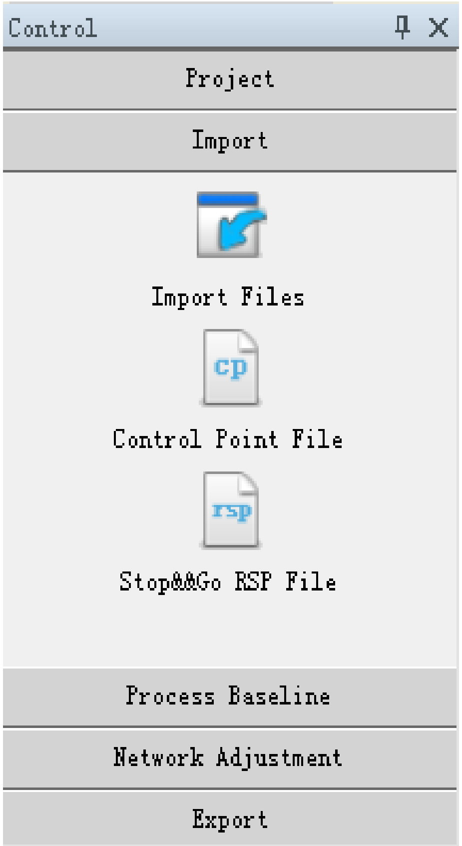


Figure 3-5

Plan View

Plan view in the work field mainly displays the added information, such as, site, baseline, error ellipsoid, scale, grid and so on.

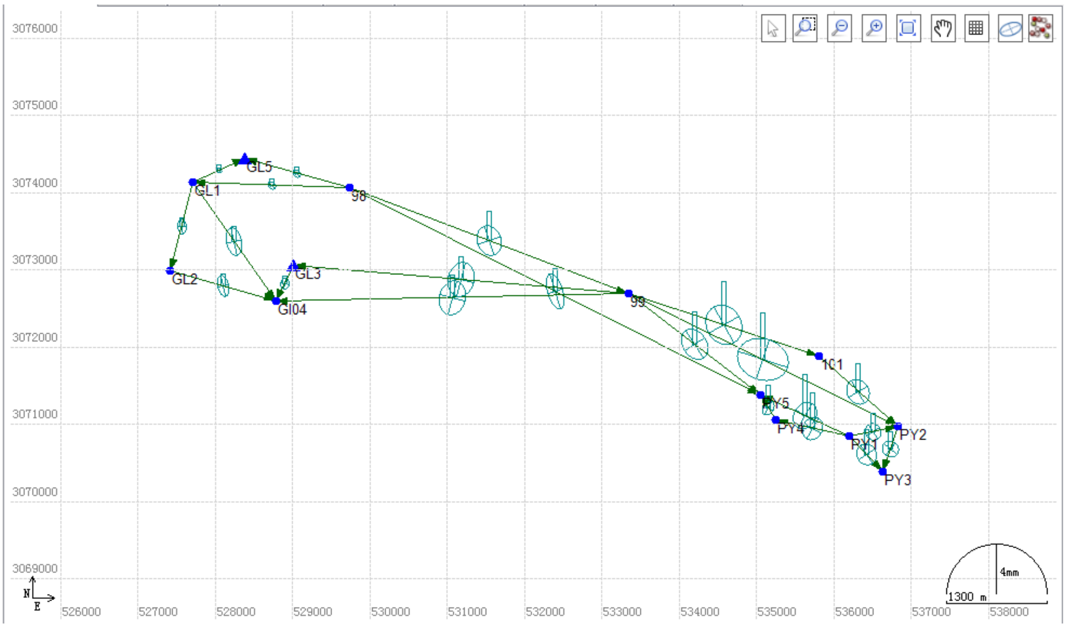


Figure 3-6

Observation Site

In the map, ▲ means that GPS observation site have been associated with the control site. ● means that GPS observation site is a common site.

Baseline

The static baseline is marked by arrowhead line, and the arrowhead can be hidden. When it is not resolved, or don't be resolved, the baseline is gray.

Move the mouse, when you click on the site or baseline, the site or the baseline will be lighted as Figure 3-7.

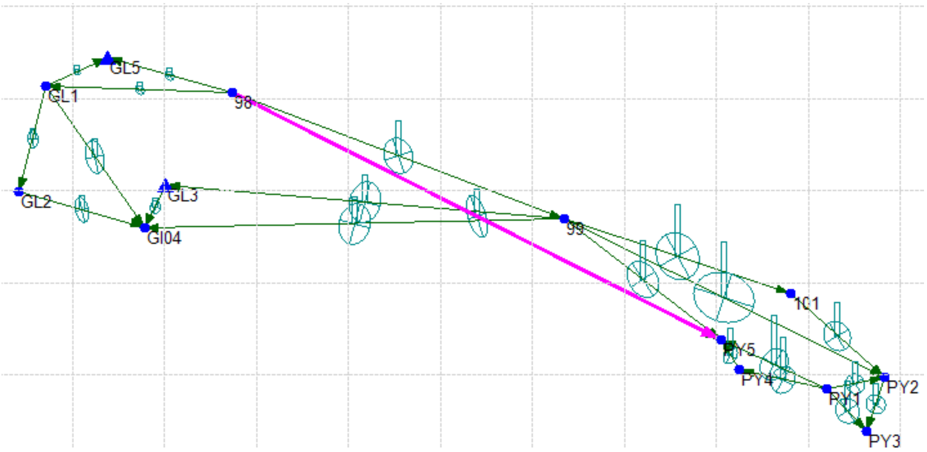


Figure 3-7

Error Ellipsoid

After finishing baseline processing the error ellipsoid and the height residual of baselines will be displayed with green color. It shows the baseline resolving quality.

Graphical Operation Tools

Graphical operation tools is on the upper right corner of the plan view. Click on the tool firstly, then click on the network graph, you will achieve the corresponding graphical operation.

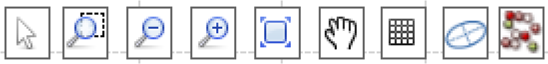


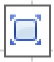
Figure 3-8

 Select Button: Select the site and baseline of the network graph.

 Square Select Zoom Button

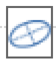
 Zoom Out Button

 Zoom In Button

 Full Screen Button

 Pan Move Button

 Grid Reference Line Displayed Button

 Error Ellipse Displayed Button

 Rover Point Displayed Button

Setting the Drawing Mode of Plan Grid Reference Line

Chose ***Options->Customize*** menu item, enter custom configuration dialog (Figure 3-9).You can set the drawing mode of plan grid reference line as plan or geodetic coordinate by setting the second item.

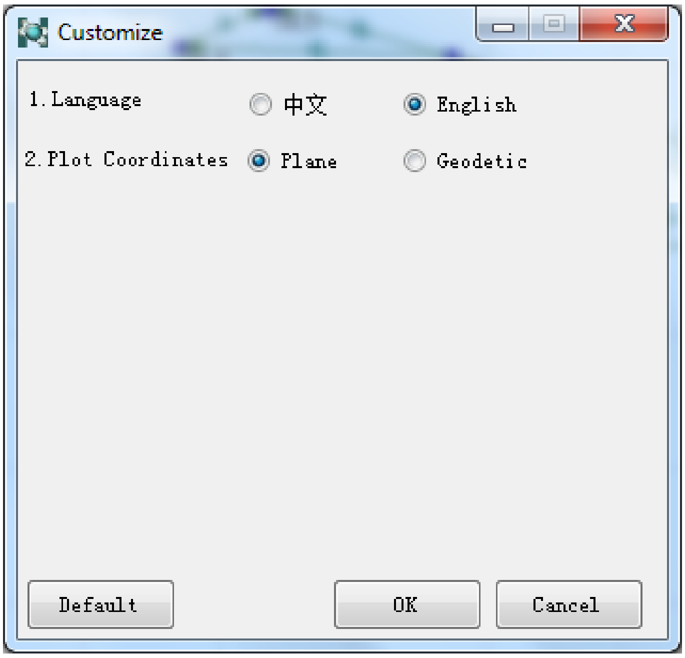


Figure 3-9

Tree List View of Work Field

The left of the work field is a tree list view. It is used to manage all context of the project, including points list, baselines list, synchronous loop list, asynchronous loop list, observation files list, ephemeris files list. Click on one node in the list, the detail view which is in the work field will display some related information according to the selected node. Then For example, click on ***Points*** node, the detail view will display Project Plot, Points and Control Points, and position on Points tab (Figure 3-10).

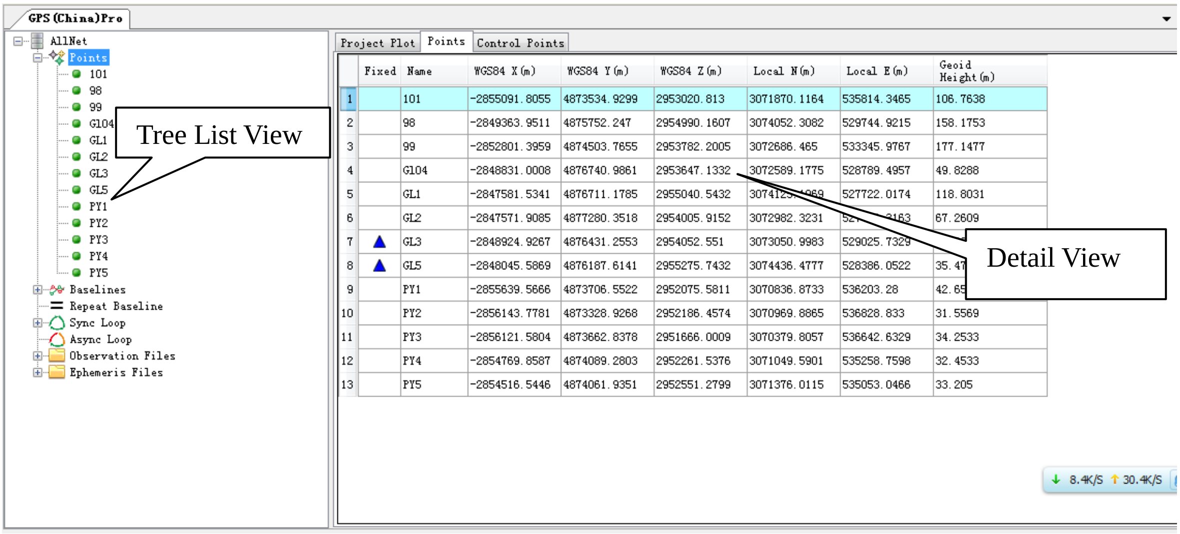


Figure 3-10

Detail View of Work Field

The detail view of work field contains several tabs, every tab will display or hide to get different display combinations according to the selected node of tree list.

Notice: The tabs of detail view will change automatically according to the selected node of tree list, users don't need to search.

Pop-up Menu of Detail View

Chose one item in the detail view, and right click on it, the pop-up menu will display as Figure 3-11.

Notice: Pop-up menu will change as the tab content changes.

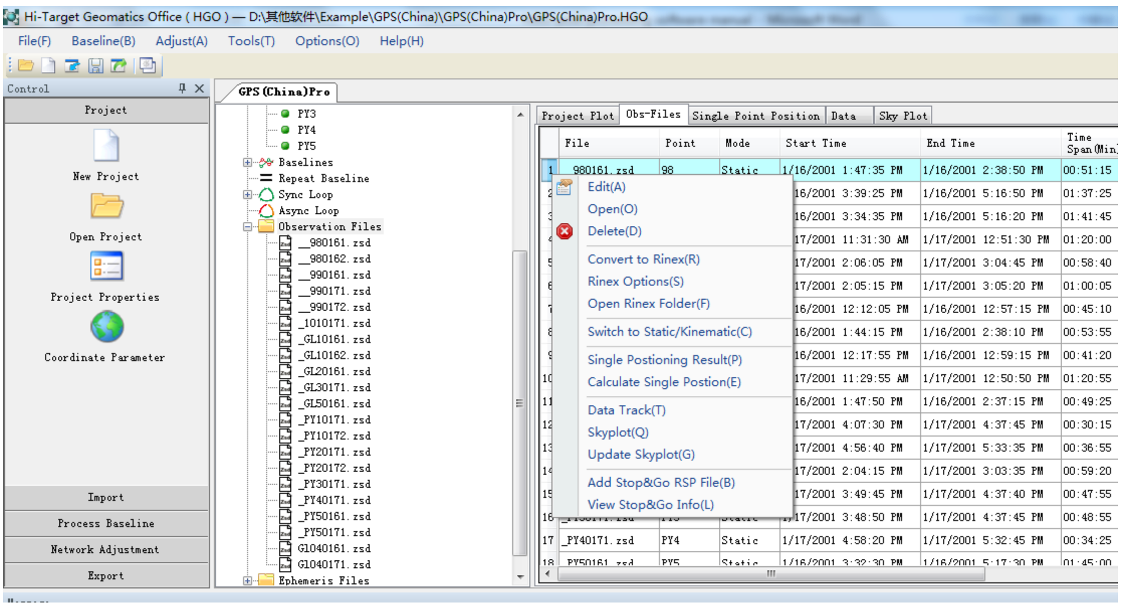


Figure 3-11

Property Window

Chose ***Edit*** item in the pop-up menu, you can edit properties of the selected item. Property Window is different as different tab of detail view.

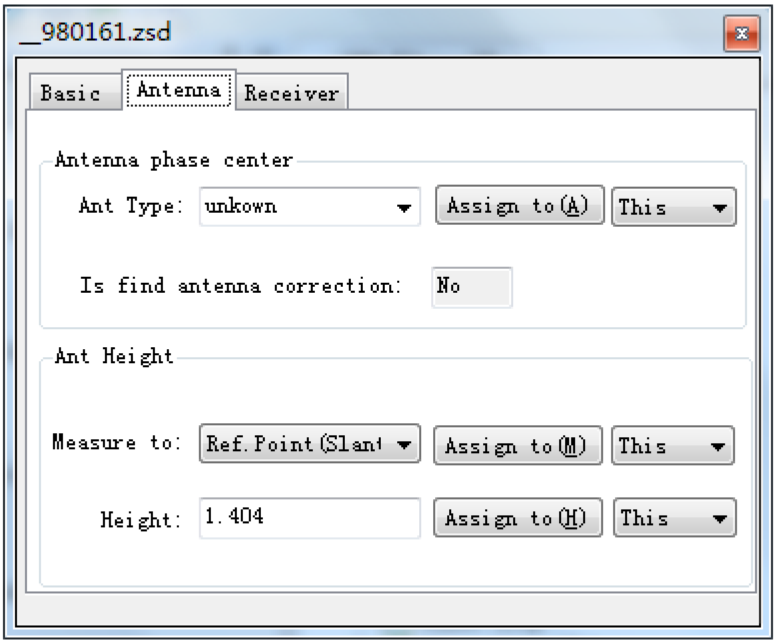

_980161.zsd
Basic
Antenna
Receiver
Antenna phase center
Ant Type:
unkown
Assign to(A)
This
Is find antenna correction:
No
Ant Height
Measure to:
Ref.Point(Slant
Assign to(M)
This
Height:
1.404
Assign to(H)
This

Figure 3-12

CHAPTER

4

Project Management

Introduction:

- Create a New Project
- Observation File
- Observation Station
- Baseline
- Repeat Baseline

Hi-Target Geomatics Office Software Package is managed via the Object Oriented method, so no matter to do point positioning or do static baseline processing or dynamic route processing even to do network adjustment, you should create a new project or open an established project firstly.

Create a new project following these steps:

1. Create a new project firstly, enter the project name and the save path;
2. Enter property and tolerance of the project;
3. Enter the coordinate parameters in the coordinate management system

After this, you can do the next operations.

Create a New Project

Set the Property of a Project

Click ***Project*** menu / ***Project property*** or click in the navigation field to set the property of the project.

Base Information

The basic Information all display in the report of the network adjustment.

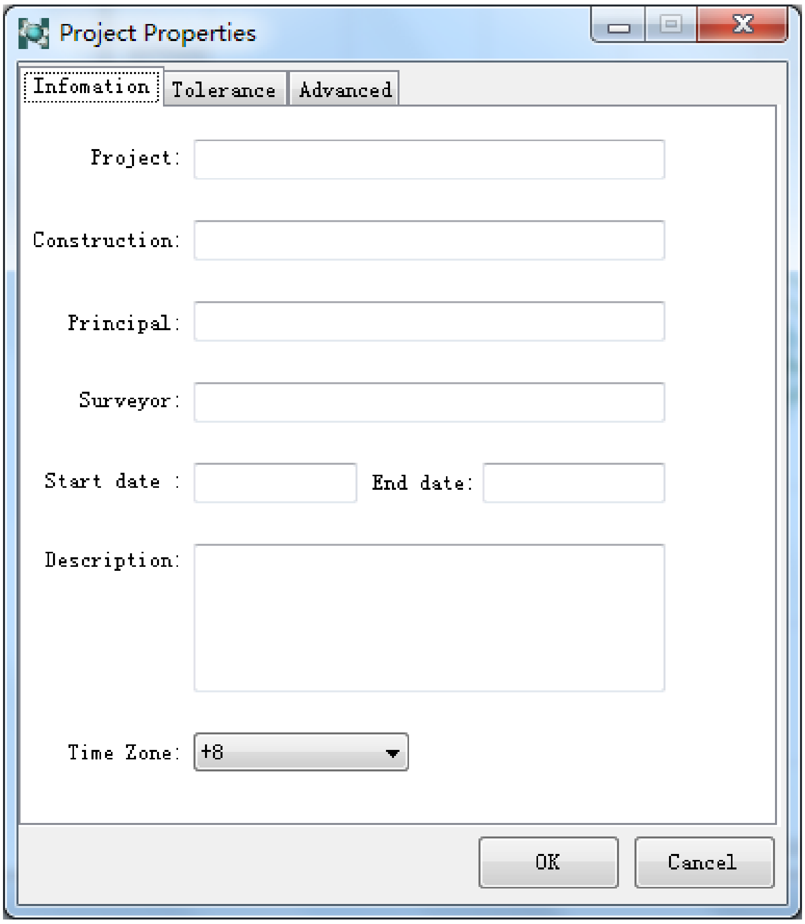


Figure 4-1

Tolerance

The tolerance of project is very important. You can choose using national standard or custom define standard. Many tests are conducted according to the tolerance settings during data processing. The details precision dilution can be found in the Global Position System (GPS) Survey Criterion.

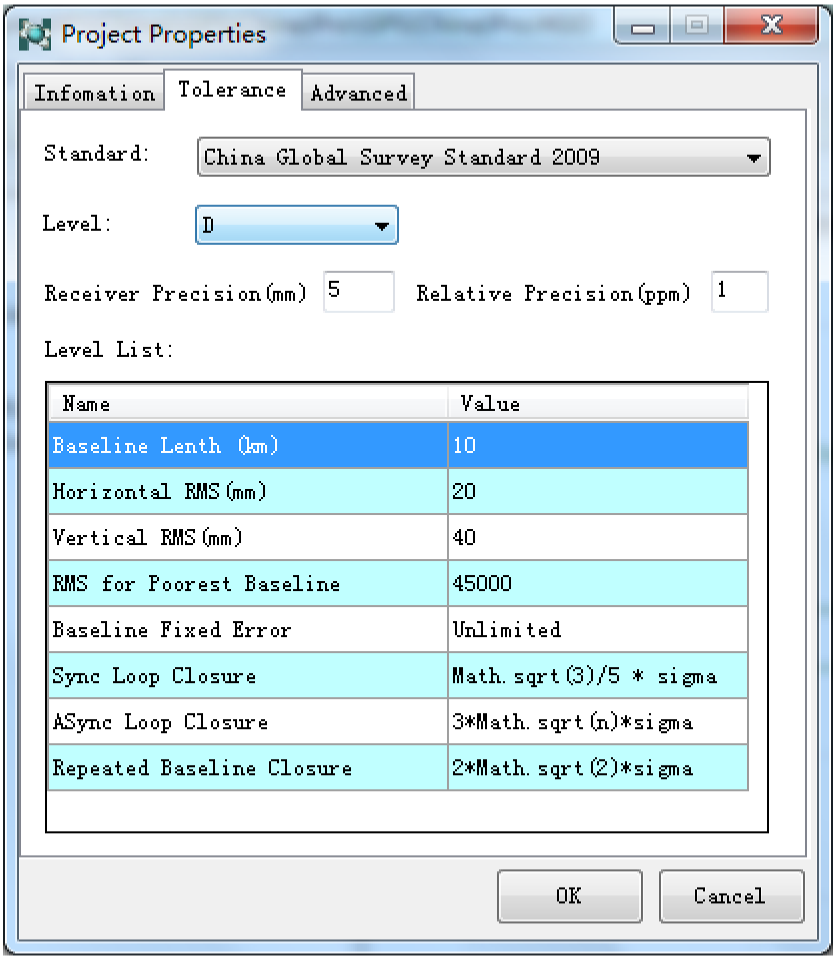


Figure 4-2

Advance

Advance setting decide the control item of data processing. Such as using first four characters of *ZHD file as the point name of observation file, Minimum Time span of Static Baseline and Dynamic Baseline.

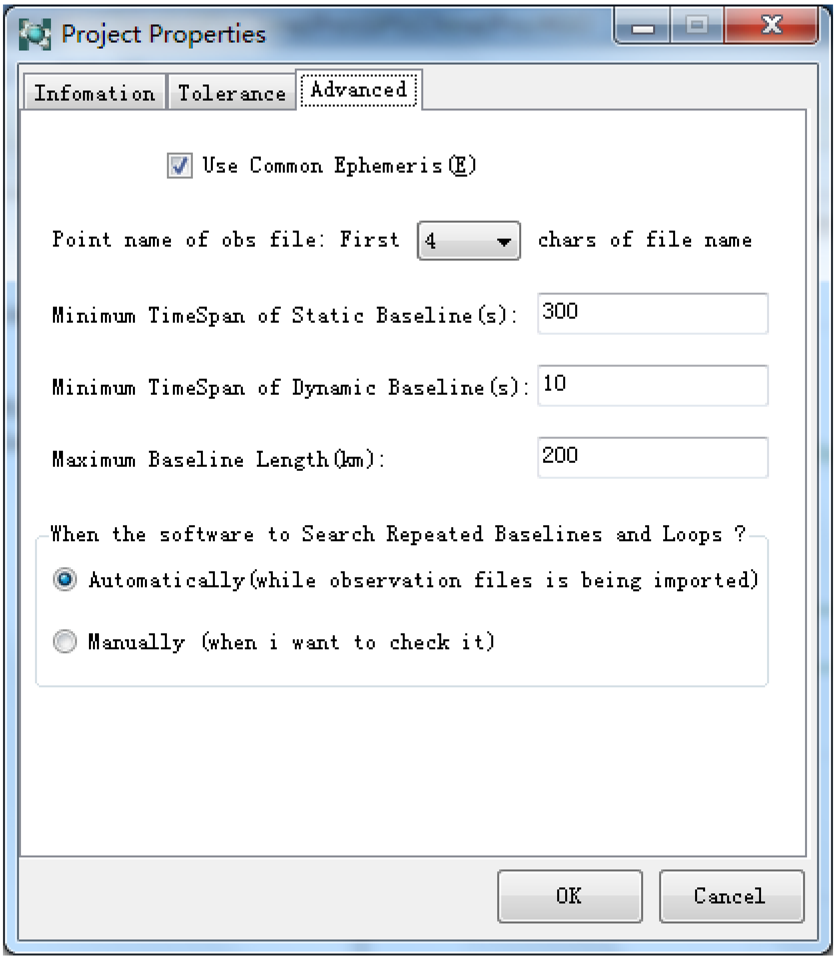
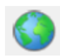


Figure 4-3

Set the Coordinate Parameters

Click ***File*** menu->***Coordinate System*** item or click  in the Project navigation field to set the coordinate parameters. Generally, you can set coordinate parameters by following common three steps.

Set Ellipsoid

Ellipsoid tab page can set the Source Ellipsoid and Target Ellipsoid. You just need to select the ellipsoid name in the Ellipsoid combo box. If the ellipsoid can't be found in program, please contact our technicians and provide parameters of the ellipsoid.

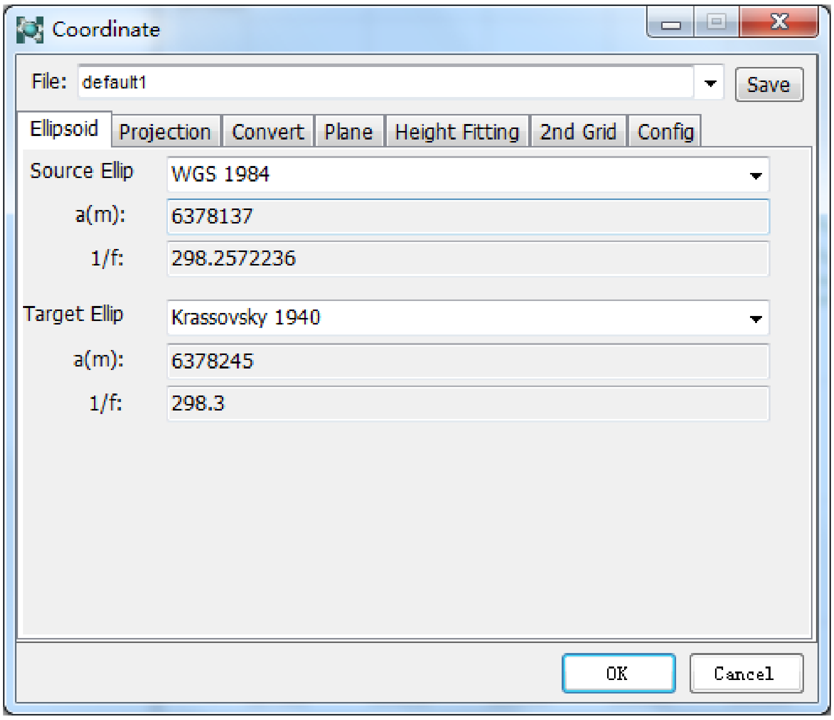


Figure 4-4

Set Projection

Projection tab page includes projection method and parameters of projection. Select the projection method and enter the corresponding parameters. If the projection method is not available, please contact our technicians and provide the calculation method and corresponding parameters.

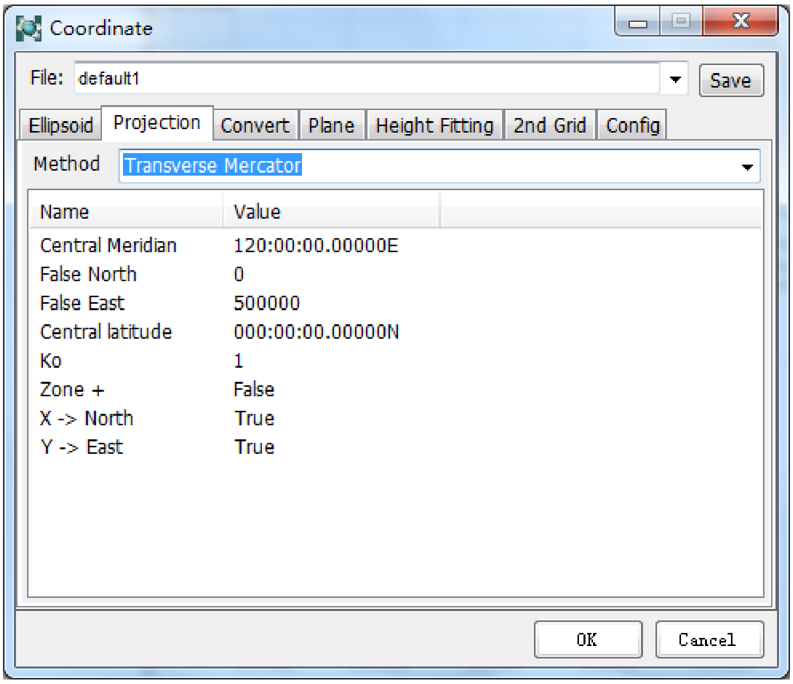


Figure 4-5

Set Conversion

Convert tab page is used to set parameters of datum conversion. Select one model in the Model combo box and enter the corresponding parameters. If you have no model parameters, you can use our Coord Tool to calculate. If the model is not available, please contact our technicians and provide the calculation method and corresponding parameters.

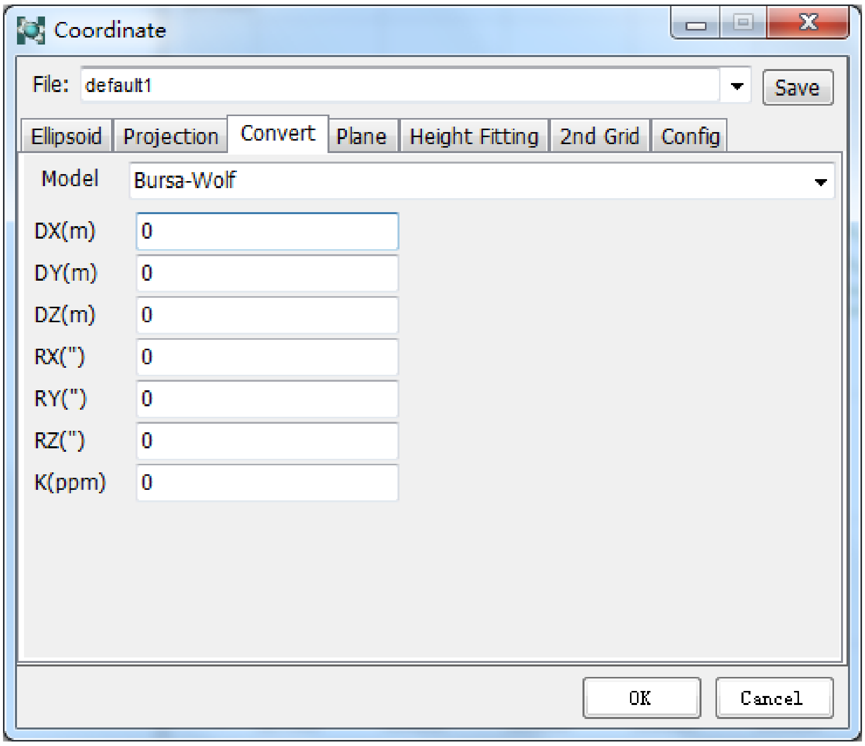


Figure 4-6

The files will be created during a project processing. These files are saved in the project route and subdirectory. When we view the project subdirectory (Figure 4-7), we can find a project file "*.HGO" and six subdirectories created in the project directory. Adjust subdirectory is used for save the information during adjustment processing, Baseline subdirectory is used for keep the baseline processing information, EphBinData subdirectory is used for save the Ephemeris data, ObsBinDat subdirectory is used for save the observation data, Report subdirectory is used for save the report document, Rinex subdirectory is used for save the rinex files transformed from the observation files.

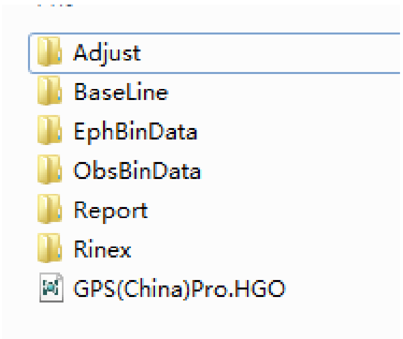


Figure 4-7

So all the data and the processing information are saved in the same subdirectory, when completed this project, you can pack and save the whole directory and the corresponding subdirectory. In addition, the project folder can be transplanted from one computer to another computer and be opened.

Observation File

The data formats exported by the GPS receiver are NEMA0183 and the original survey data. In the term of HGO (Hi-Target Geomatics Office) Software Package, it needs the original survey format. The original surveying data of most GPS receivers is binary system, whose formats are differently.

HGO Software Package can process the defined format, and also process other data format of several common GPS receiver, and it supports RINEX text format, too.

The Content of the Observation File

The observation files mainly save the original observation data of each ephemeris recorded by the GPS receiver. Each ephemeris includes observation time and the satellite information of every channel, C/A code, P1 code pseudo-range, P2 code pseudo-range, L1 carrier phase, L2 carrier phase. For the static observation files of the HGO Software Package, it is necessary to include the observation time, C/A code pseudo-range, L1 carrier phase; For dynamic observation files it is necessary to include the observation time and the C/A code pseudo-range.

The observation files include information besides the above of the point information, initial coordinate and the ephemeris information correlative the observations files.

In order to process stop&go data, stop& go time files is necessary except for static data file. It includes the start observation time and end observation time of a point.

The observation files can be expressed as the follow Figure 4-8:

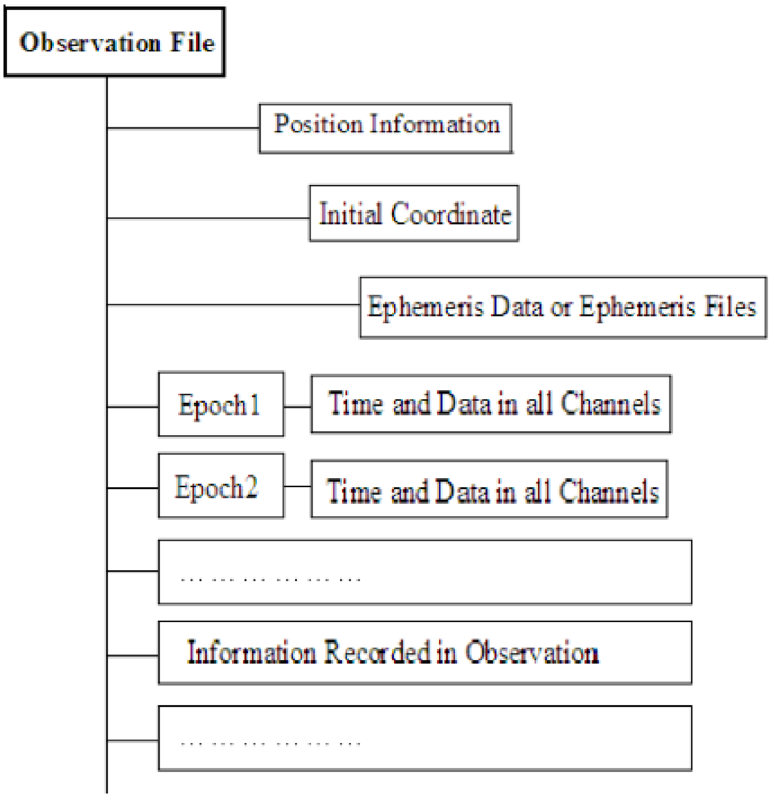


Figure 4-8

The ZHD/GNS Format Observations of Hi-Target Receiver

The observation files of the ZHD or GNS Format defined by Hi-Target all include the original observations, ephemeris data, the coordinate of the start and end point, several editions include the point information, rout information of the dynamic capture record.

The Observation in the RINEX Format

In order to process the data unified collected by different types of receivers, the RINEX Format data which is a universal data transform format is established. The RINEX Format is brought forward by the Berne Univ.Astro.Inst in Switzerland, which has become a standard format programming all the manufacturers, schools and institutes. And currently the main GPS receivers are all able to transform the observations to the RINEX format.

Other Observation Format

HGO also support other observation format, such as SP3 format.

Data Preparation

The HGO Package has the ability to process a few types of data format.

Generally, you should do the next steps before processing a group of GPS observations:

Import Data

Click File menu->Import or click  in the navigation field.

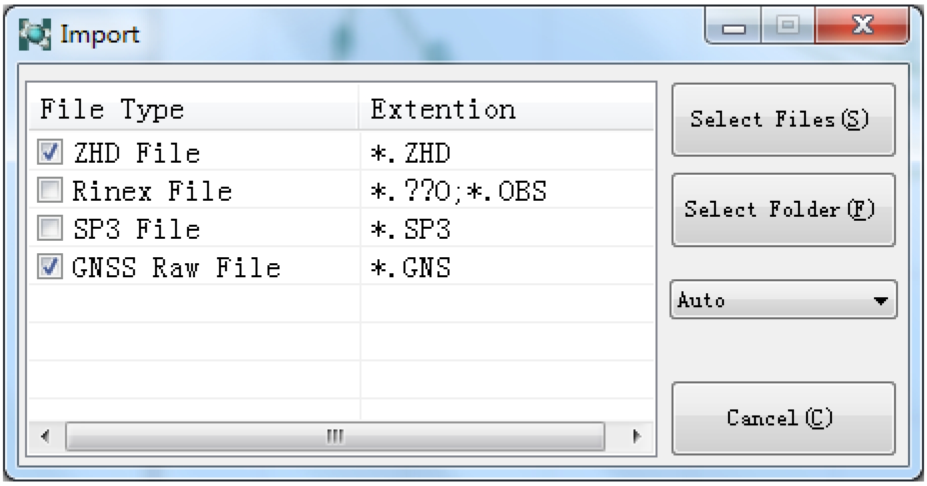


Figure 4-9

At the right of the dialog, there is an Observation file mode combo box, it includes Auto, Static, Dynamic three modes.

Auto: Import both static and dynamic data file. The mode of all imported files is static.

Static: Import static data file.

Dynamic: Import dynamic data files which is exported by rover.

Import folder, the HGO Package can import all files which meet the conditions automatically.

If you select import GNS data files, the program will pop-up a file dialog as Figure 4-10.File dialog will be transferred to the path of current project and lists all files with corresponding extension. You can select one file or multiple files at once.

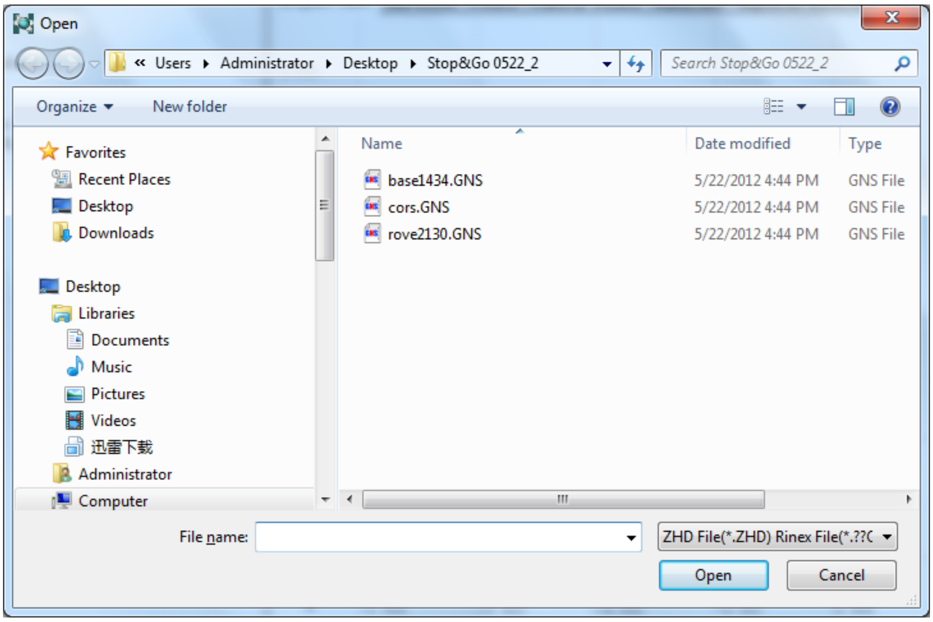


Figure 4-10

File import only imports observation files. In fact, at the same time, it imports the corresponding ephemeris files. For the files in the ZHD/GNS format, the observations file and the ephemeris are included in one file, so they are imported at the same time. For other format, the observation file and the ephemeris may be not in the same file, then they should be saved in one directory, and the software will automatically distinguish and import the ephemeris by the format of the file. Or else, the user should enter the ephemeris in the post processing.

After imported the files, the soft will get the observation station from the observation files and automatically assemble to the static baseline and the dynamic route by the observation time spans, you will find explanation in the following (Figure 4-11).

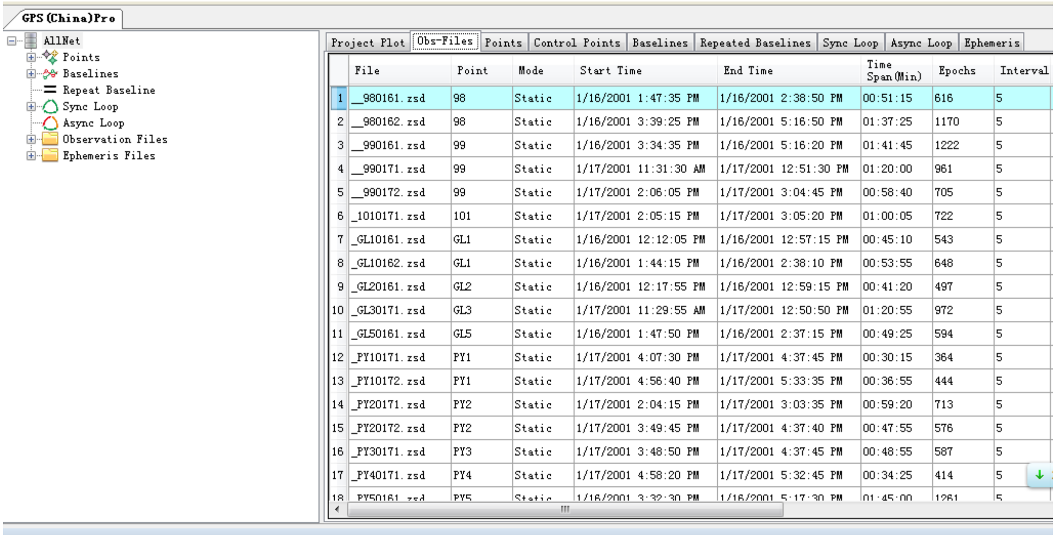


Figure 4-11

Name of Observation File

The HGO Software Package usually distinguishes different files via the file's name. The common observation file is consists of 8 file names and their extend name. For example a GNS observations file is named as ABCD1234.GNS.

In a project several files have the same name is unallowable. For example, there are two files with the same name ABCD1234.GNS in a project, which is forbidden. You can name the observations files in different ways.

ZHD/GNS Observations Files

For the file name of the *.ZHD or *.GNS static observations files of Hi-Target receiver it is consists of 8 characters in the form:

- !!!!$$$#. ZHD
- !!!!$$$#. GNS

Point Name

In the observation names, the front four! Denote the point name, the point name can be characters or figures, and also can be two Chinese characters. After downloading the observation files, the software will analyze point name automatically, if the number of the characters in the point name fewer than four, it will be add underline before the name to four characters via the collection software and or the data transferring software by the HD8200. For example point name A will become "___A".

The after three figures and an English character or figures "$$$#" denote the period of time. The $$$ express the Day in a Year, that is the order of the observation day in a year. See Appendix B about the Day in a Year, the # expresses the observation sequence of a day which can be denoted by 1, 2, 3 … A, B, C,….

For the ZHD/GNS dynamic observation files of the HGO, the file is named as the same way, but the observation site name is of no meaning which is only be used for identifying the different files.

Rinex Observations Files

The name of the RINEX Format is as the following:

- ✧ Observations file: !!!!$$$#. yyO
- ✧ Ephemeris file: !!!!$$$#. yyN

It is obvious that the name regulation of the RINEX file is like to the ZHD/GNS file, what different is that yy denotes the year of observation. The MARKER NAME in the RINEX form has the name of the observation station, if it is empty, the software will resolve the observation file's name in the way of reading file name in the ZHD/GNS file, then form the site information.

If some files with the RINEX format are not named as this rule, you should rename the file before importing it into the HGO Software Package.

Other Observation Files

See correlative information about the other observation files.

Pop-up menu of the Observation File

Chose one file in the Obs-Files tab of the detail view, right click on it, then the pop-up menu will display as Figure 4-12.Thus, and you can operate observation by clicking these menu items.

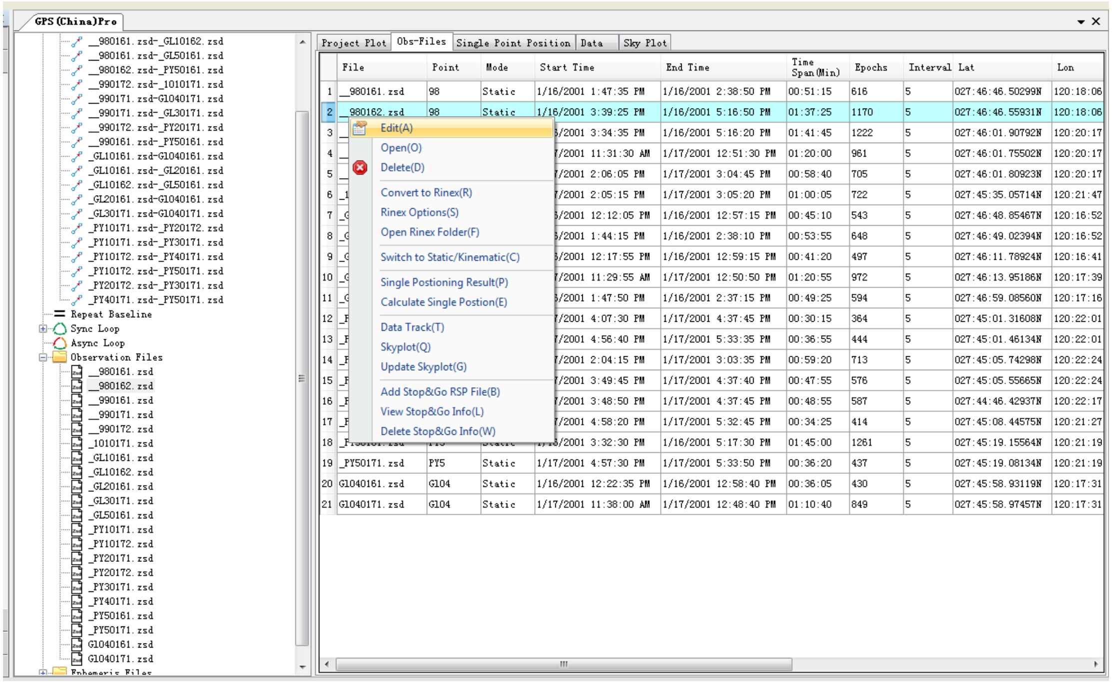


Figure 4-12

Property of Observation File

Chose one file in the Obs-Files tab of the detail view, right click or double click on it, and chose ***Edit*** item in the pop-up menu. You can edit the property of the selected observation file on following window as Figure 4-13.

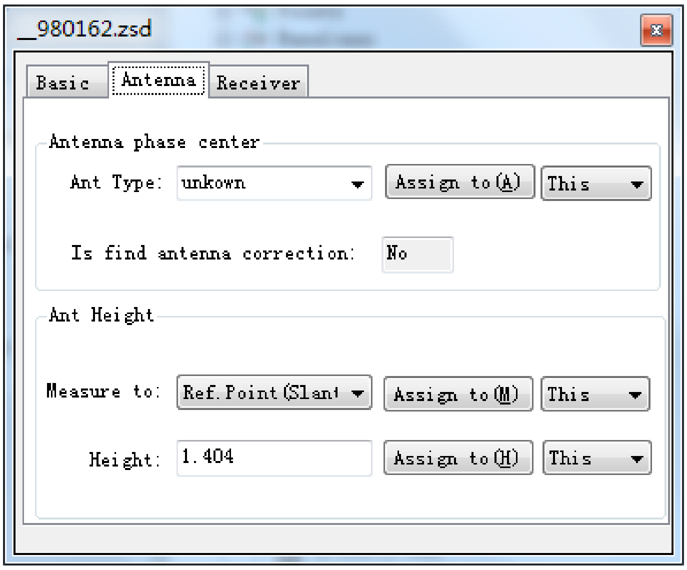


Figure 4-13

Single Point Positioning Result of Observation File

Choose one file in the Obs-Files tab of the detail view, right click on it, and chose ***Single Positioning Result*** item in the pop-up menu. Then Single Point Position tab will be activated, the single point positioning result of observation file displays in the plan view as Figure 4-14.

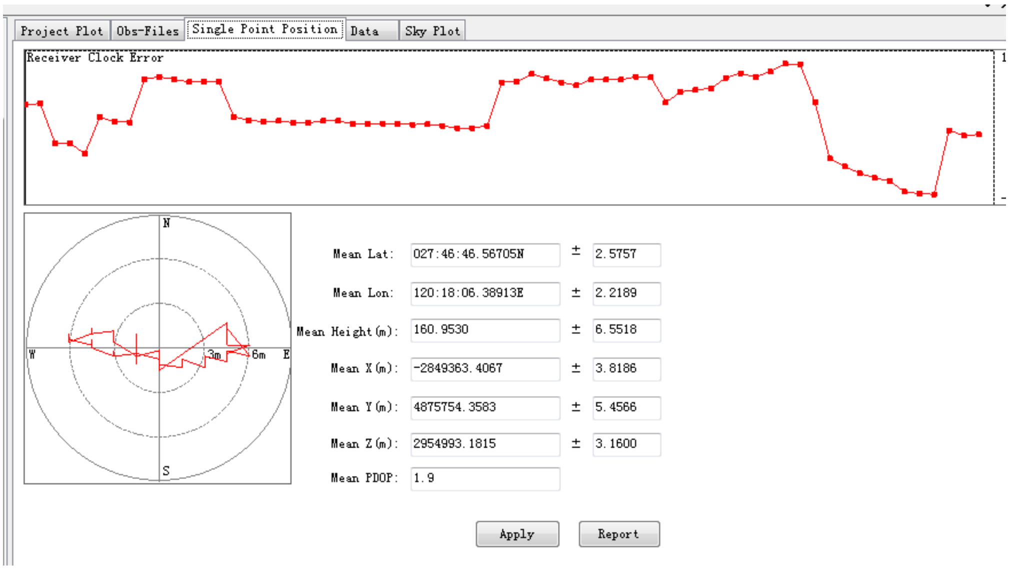


Figure 4-14

The Data Track Map of Observation

Choose one file in the Obs-Files tab of the detail view, right click on it, and chose ***Data Track*** item in the pop-up menu. Then Data tab will be activated, the tracking information about each satellite of the selected observation file displays in the plan view as Figure 4-15.The interrupt part show the serious unlocking of the receiver.

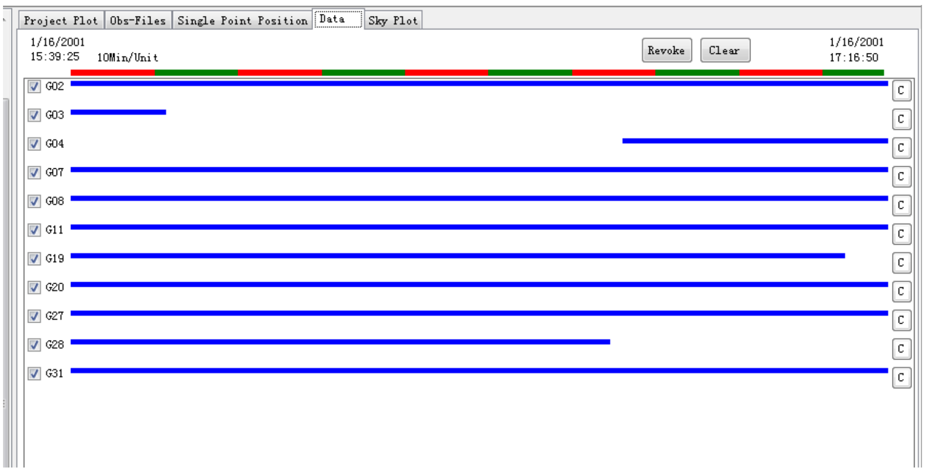


Figure 4-15

The Tracking Satellite Map of Observation

Chose one file in the Obs-Files tab of the detail view, right click on it, and chose ***Skyplot*** item in the pop-up menu. Then Sky Plot tab will be activated, the sky plot and SNR (Signal to Noise Ratio) plot about all the tracking satellites of the selected observation file displays in the plan view as Figure 4-16.

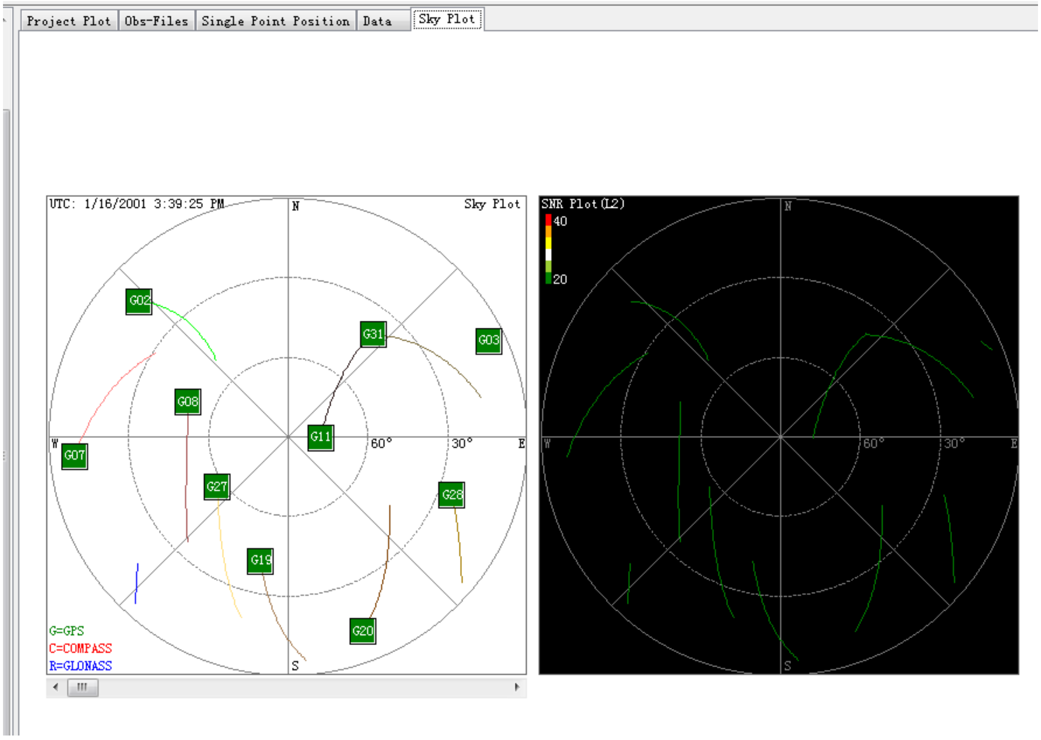


Figure 4-16

Transform Observation Data to the RINEX Format

Choose one file in the Obs-Files tab of the detail view, right click on it, and chose ***Convert to Rinex*** item in the pop-up menu. Then the selected observation data files will be transformed to the RINEX format files(Figure 4-17).The property of RINEX file can via choosing ***Rinex Options*** item menu in the pop-up menu to set up(Figure 4-18). The created files are saved in the RINEX subdirectory of the corresponding project directory. You can view them by choosing ***Open Rinex Folder*** item menu.

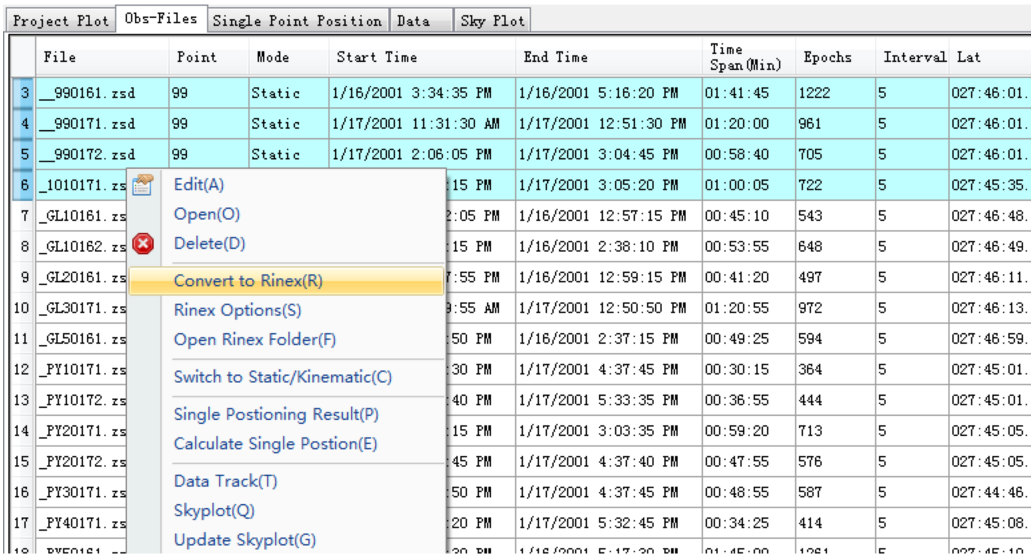


Figure 4-17

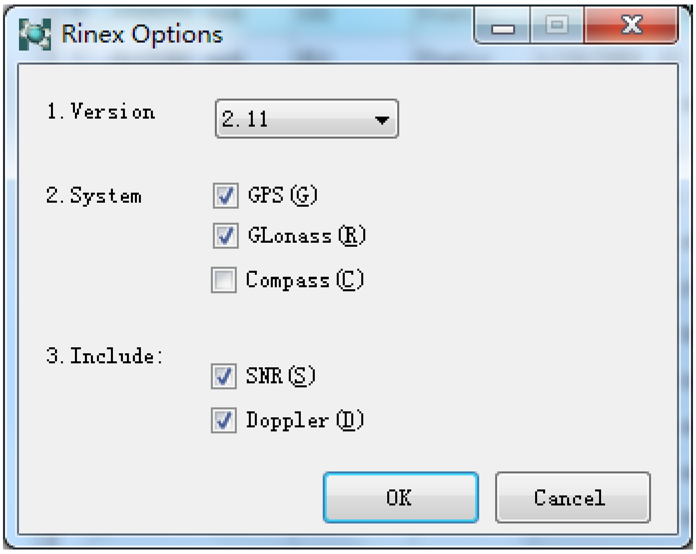


Figure 4-18

Stop &Go RSP File

If you do stop&go data processing, you need to add stop&go RSP File (stop&go time file) to dynamic file. Choose one file in the Obs-Files tab of the detail view, right click on it, and choose ***Add Stop&Go File*** item in the pop-up menu(Figure 4-19),then you can get it. Click on ***View Stop&Go RSP File*** to view RSP file you have added.

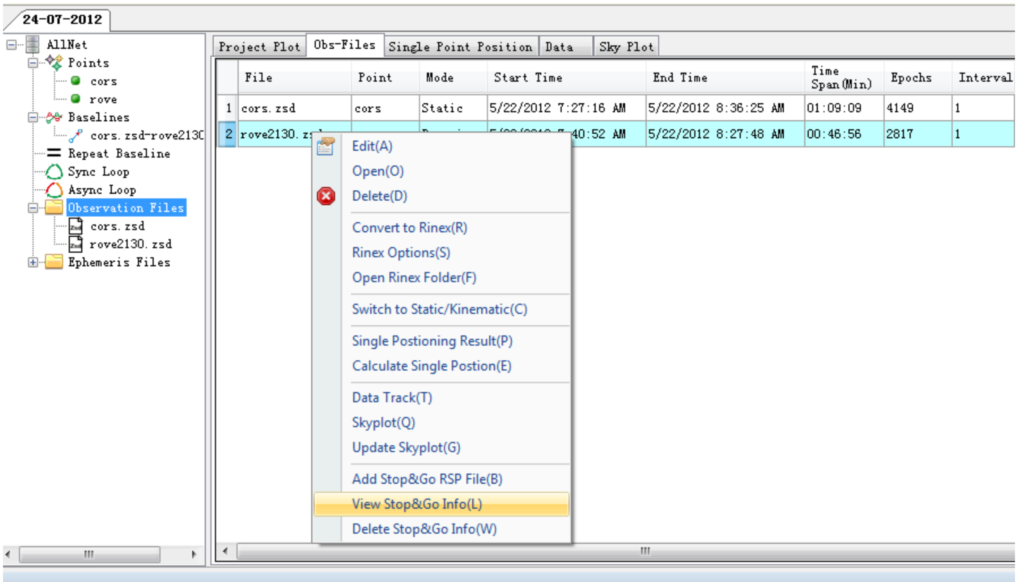


Figure 4-19

Certainly, you can delete stop&go RSP File too, just chose ***Delete Stop&Go Info*** menu item in the pop-up menu.

Observation Station

Click on the ***Points*** node in the tree list view, and the right detail view will display information about site. There are two tabs in the right detail view, including points tab, control points. The control point list information is used to adjust network, and has nothing to do with baseline procession.

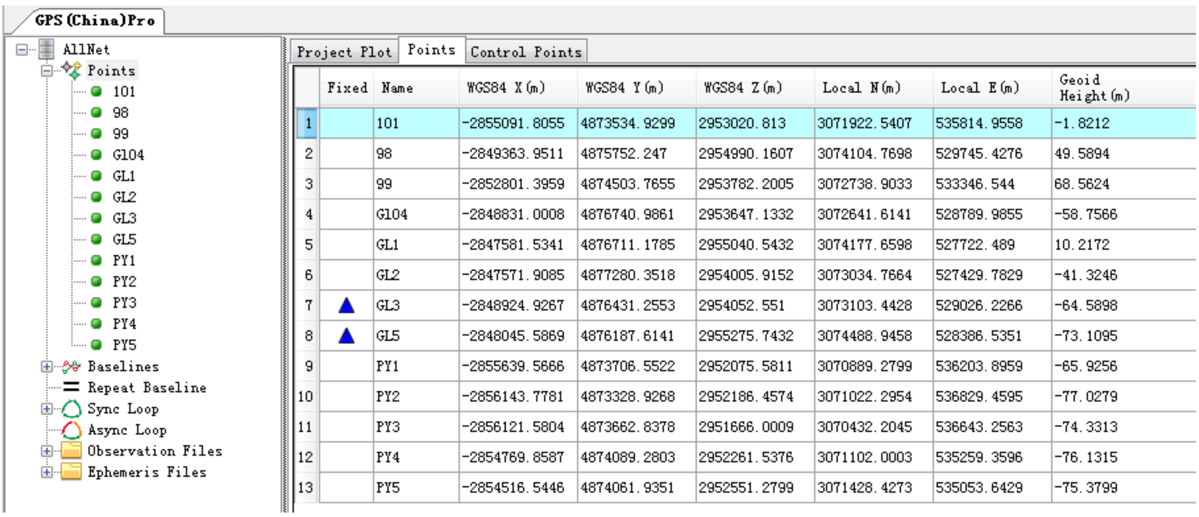


Figure 4-20

The detail view lists each observation site name, fixed (whether the control points associated with it), spatial rectangular coordinate under WGS84 coordinate system and grid coordinate in local.

Pop-up Menu of Observation Station

Right click on the selected site, pop-up menu display as Figure 4-21. You can do some operation about site.

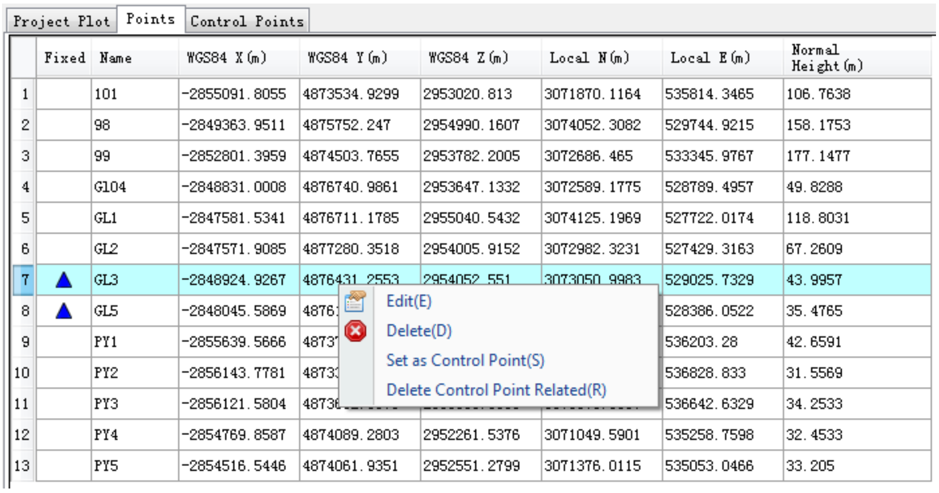


Figure 4-21

Property of Observation Site

Chose ***Edit*** menu in the pop-up menu or double click on selected site, you can set the property of the observation site, such as its name, WGS coordinate, local grid coordinate.

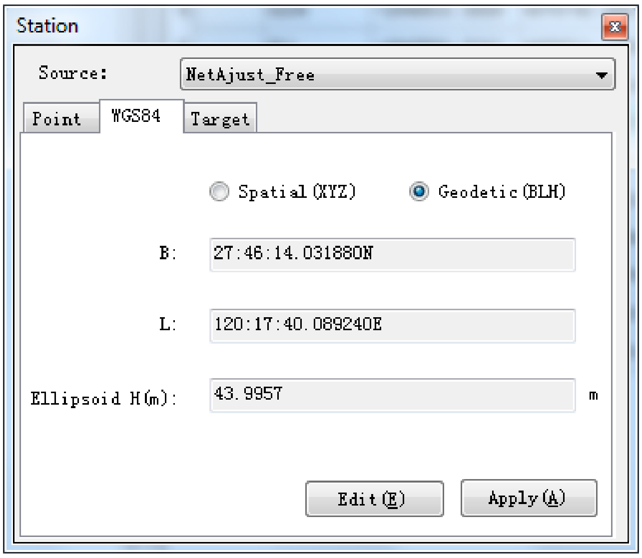


Figure 4-22

HGO software package record all coordinate source, such as observation file. You can change the coordinate source of site by selecting source in the source combo box and apply it by clicking ***Apply*** button. Certainly, you also can enter coordinate by clicking on ***Edit*** button.

Baseline

Click on the ***Baselines*** node in the tree list view, and the right detail view will display information about baselines (Figure 4-23).

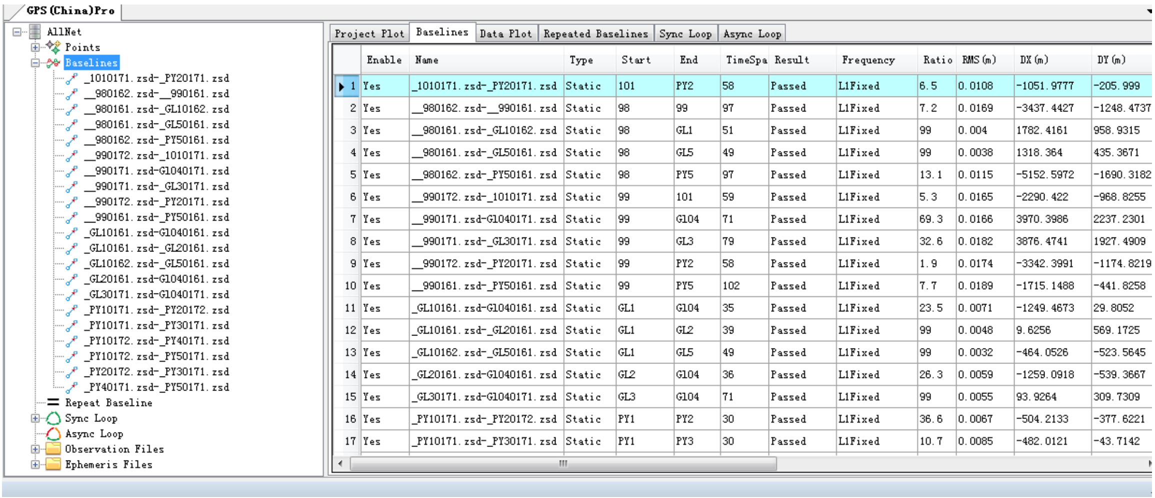


Figure 4-23

Pop-up Menu of Baseline

Click on the ***Baselines*** node in the tree list view, and the right detail view will display information about baselines (Figure 4-24).

You can do operation about baseline by pop-up menu. Such as setting procession option, processing baseline, viewing report, delete baseline.

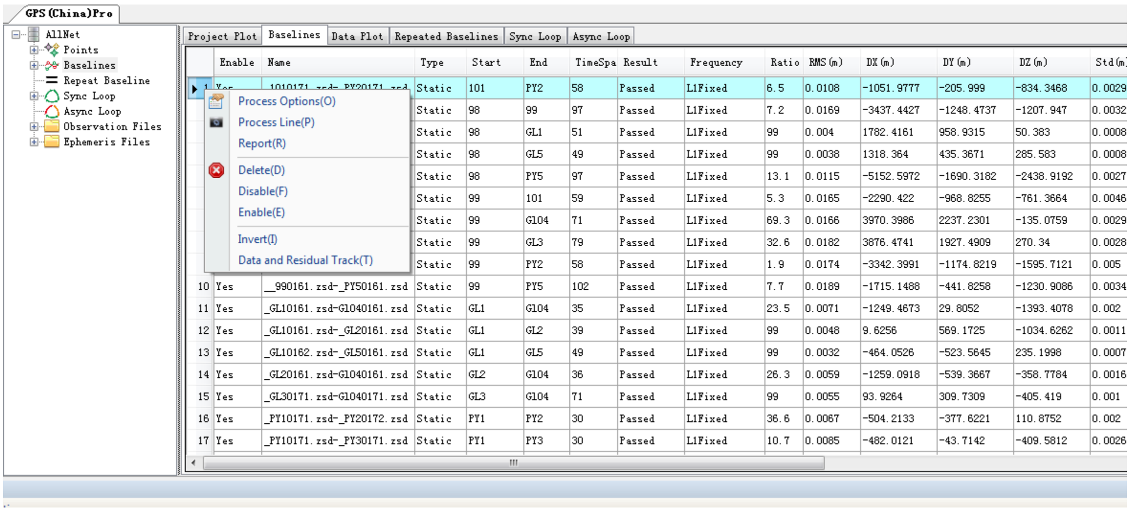


Figure 4-24

Repeat Baseline

Click on the ***Repeat Baseline*** node in the tree list view, and the right detail view will display information about repeat baseline (Figure 4-25).

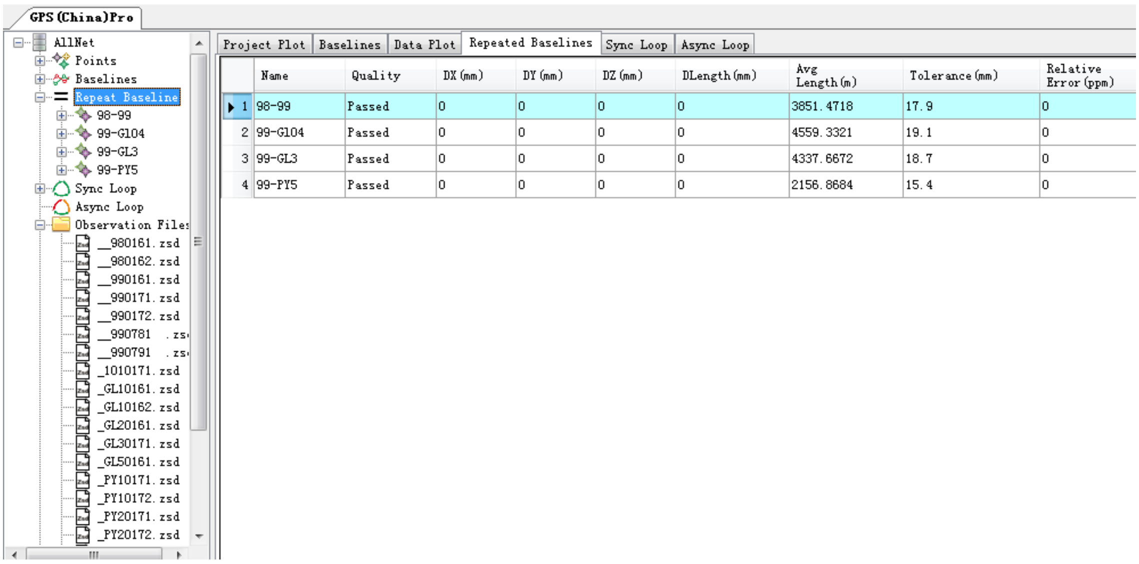


Figure 4-25

CHAPTER

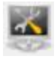
5

Baseline Processing

Introduction:

- Process Options
- Baseline Processing
- Test Baseline Processing Result
- Reprocess a Baseline
- Dynamic Route Processing

Processing Options

Before processing baseline, you should set processing options. Right click on one baseline, chose ***Process Option*** item in the pop-up menu, or click on  in the navigation filed, the following dialog display:

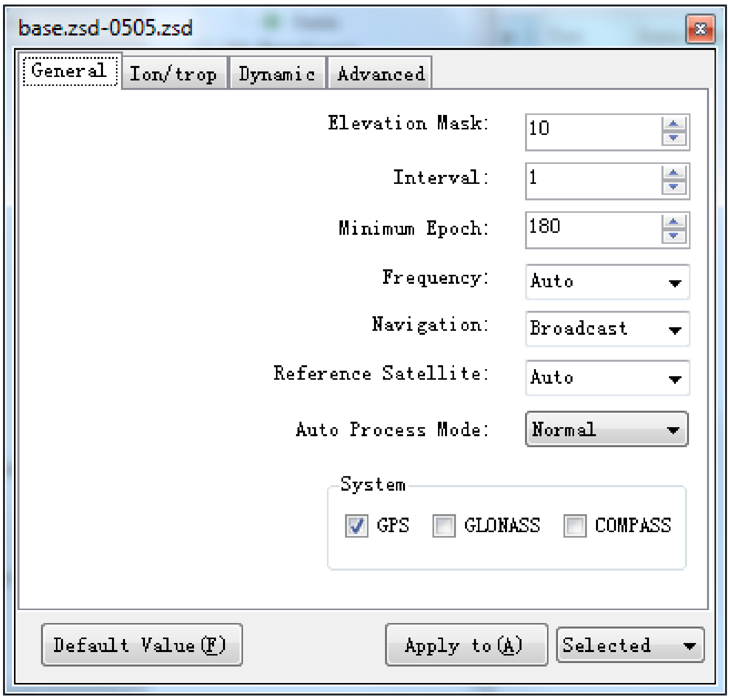


Figure 5-1

The dialog is consisting of four setting pages: General, Ion/trop, Dynamic, Advanced.

General Setting

For pure static baseline, the minimum epoch count is 5s, or observation data can't form the baseline; for dynamic baseline, the minimum epoch count is 180, or the integer ambiguity can’t be fixed.

Cutoff Angle

Cutoff angle is used to limit the satellite data with relatively lower height angle, these data won’t be processed when you processed baseline.

The influence of atmosphere is more complex for the lower height satellite signal, it is difficult to use model to correct. In addition, the signal of lower height is respect by various factors, such as multi-path effect, electromagnetic waves. So the quality of these satellites signal is relatively worse, we remove them in the data procession.

From the atmosphere refraction perspective, observation for a short distance can be reduced cutoff angle height; for long distance observation, it should to be increase the height of cutoff angle. The shorter the distance, atmospheric refraction affects is easier to cancel each other out. Of course, the setting of cutoff angle also depending on the observation stations for the surrounding environment.

Observation in the field, we should choose lower height cutoff angle and collect more data according to satellite distribution.

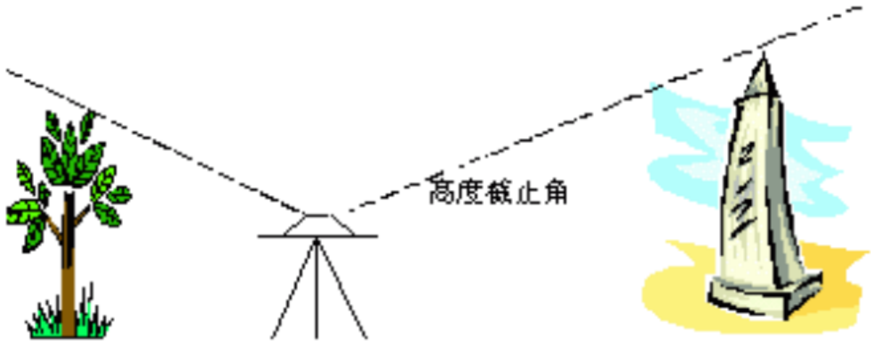


Figure 5-2

The default cutoff angle is 20 in HGO software package.

Sampling Interval

The so-called epoch interval is the data interval taken from the original observational data drawn Take in the baseline process.

For example: when two receivers are processing static surveying, they are set up to capture a group of data every 5 seconds. But when it comes to the inside processing, this high density data usually degrades the accuracy of the baseline processing, instead of increase. So in order to accelerate the processing rate, user can increase the interval time appropriately. Generally, for the short line, and the observation time is not long, you can reduce the interval time appropriately, while for the long line, you can increase the interval time. e.g. For a static baseline shorter than 2 k, and the observation time within 20 minutes, then you can set up the interval to be 5seconds. But if the baseline is longer, you can increase the interval to be 60 or 120 seconds.

Why set up so little interval surveying in outdoors? Because the randomicity of the Observations and the limit of the software, you can change the epoch interval then process the baseline again to get a better result when you have the worse data. The default epoch interval is 60 seconds.

Minimum number of epoch

Because the dual-difference is formed via the difference of the single-difference observations among the satellites, for simple processing purpose, the software fixes a reference satellite when form the dual-difference observation value. The default minimum number of epoch is 5.

Observations (Frequency)

You can choose different combinations of observed values to process baseline, such as wide lane Lw, narrow lane Ln and so on. When you choose auto mode, program can automatically select the type of observations according to the baseline length. Generally, baseline less than 5km use L1 observations, baseline greater than 5km use a Lc ionosphere-free combination observations.

Ephemeris (Navigation)

You can select the broadcast ephemeris or precise ephemeris to process. Generally, long-distance baselines use precise ephemeris can improve the accuracy of the baseline solution; for short-distance baselines, the broadcast ephemeris can meet the requirements.

Reference Satellite

The default of reference satellite is auto. As this mode, program will select the observation data of most and satellite elevation angle of higher as a reference satellite.

However, due to the influence of the conditions of observation, such a choice may not be the most reasonable .When the reference satellite selected is not reasonable, the results of the baseline processing will be affected. At this time, you need to reset the reference satellite based on observation data.

Auto-Process Mode

HGO software package has capabilities of automatically removing the gross errors in satellite data .It can help users to reduce the work of removing the data manually and make the baseline solution qualified in the shortest period of time. This feature can be enabled when the settings as the "enhanced". If the user wants to remove the data manually, just set to the "general".

Dynamic Solving Mode

This page is used to set dynamic route procession mode. Just used for dynamic route processing. Dynamic GPS data processing has three solving mode: RTD, Stop&Go, PPK (Post Process Kinematic).

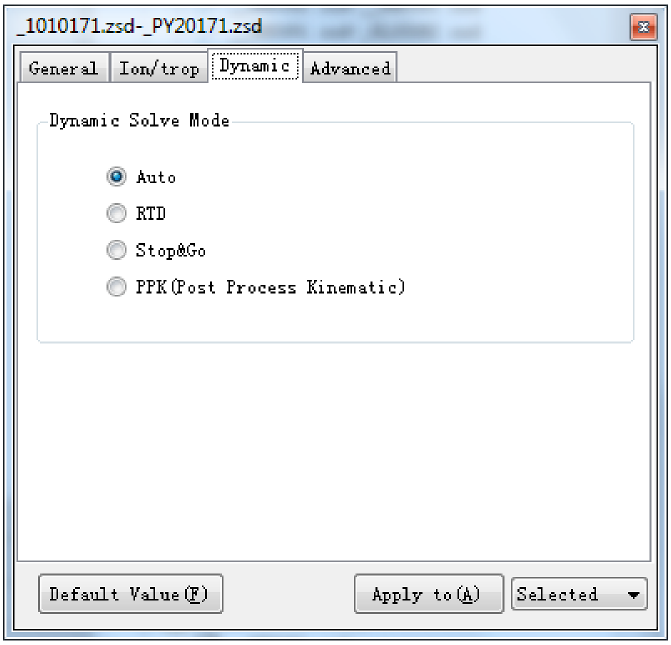


Figure 5-3

Auto: Software will choose mode to process baseline according to the existence of stop&go RSP file. No RSP file, using RTD mode, or Stop&Go mode.

RTD: The solving method of integer ambiguity for RTD solution mode is pure dynamic method. It can achieve 5 m precision within 300 kilometers and above 1m precision within 100 kilometers.

Stop&Go: This solution mode is suitable for short, middle, long baseline processing. Both stop stage and go stage is processed according to the principle of least squares method. The solving method of integer ambiguity, for stop stage, is fast static method and for go stage, is pure dynamic method. The precision of solution mode has better repetition than PPK, because it only has one ratio value.

PPK: This solution mode is suitable for short, middle baseline processing. Both stop stage and go stage is processed according to Kalman Filtering method. The solving method of integer ambiguity, for go stage, is pure dynamic method. For stop stage, integer ambiguity is obtained according to the dynamic single epoch results .The precision of this solution mode has less repetition, because every epoch has a ratio value.

Notice: If the quality of satellites single is good, the result of PPK and Stop&Go is much same. But if the quality of satellites single is worse, you'd better choose PPK solution method.

Ionosphere/ Troposphere

In general, not need to change the troposphere, ionosphere settings. Long baseline can improve the solution setting precision according to actual situation.

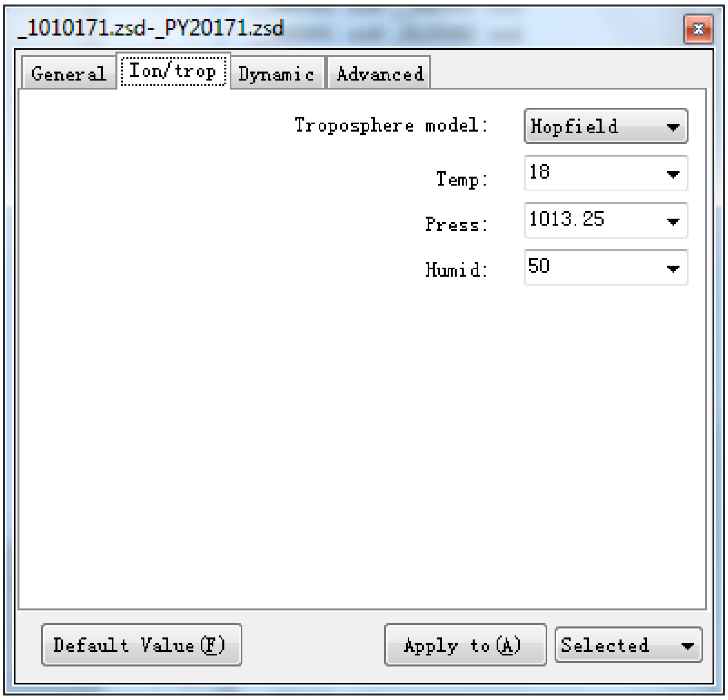


Figure 5-4

Advanced

In general, the default value can satisfy the requirement, do not recommend that users to illegal change influence the solution the stability of the engine.

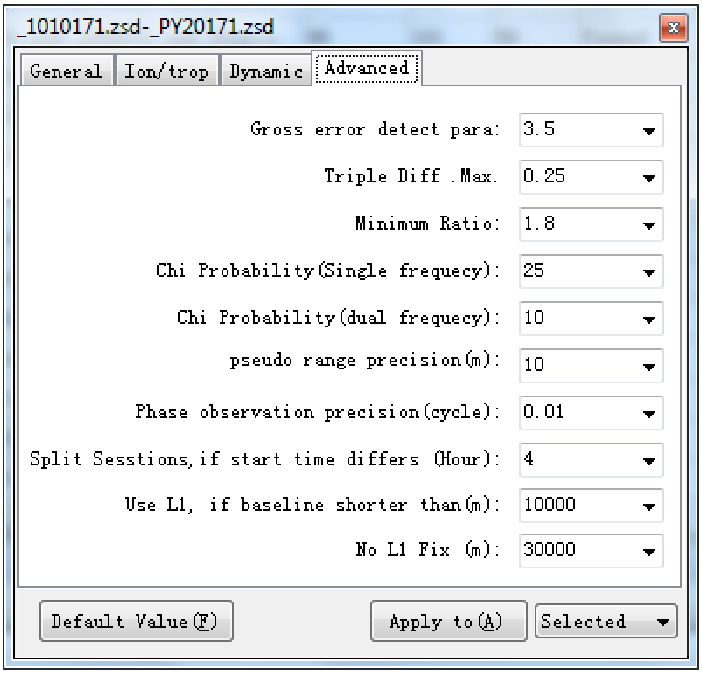
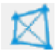


Figure 5-5

Baseline Processing

After the above setting, chose Baseline /Process line all baselines, or click on  in the navigation field, the software will process each baseline in sequence and display the information frame.

The baseline is run in the multithreading mode in the backend. During the processing, click on ***Cancel*** button, then you can stop process baseline.

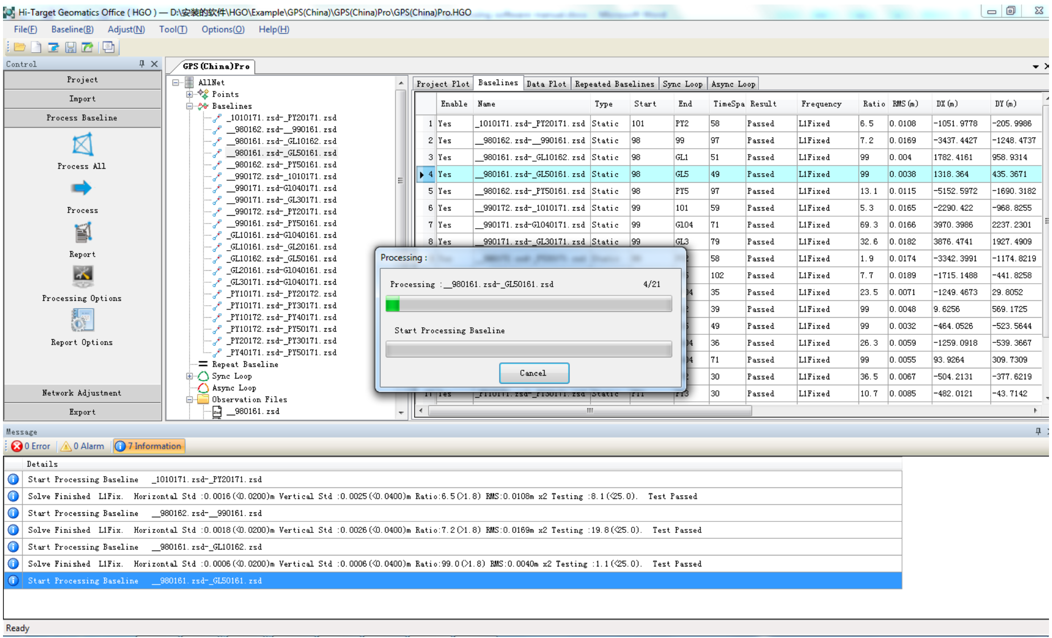


Figure 5-6

The baseline solution result will display in the message filed after the solution as Figure 5-7.

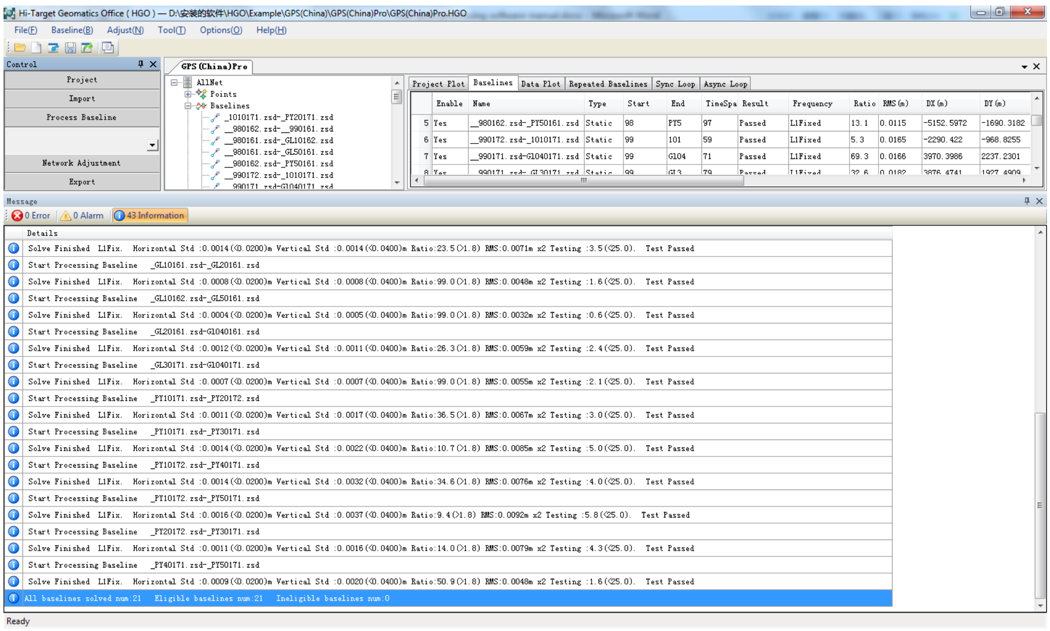


Figure 5-7

If there is warning, click on one warning message and you will find the corresponding baseline in the list. The result of the solution can form the baseline report via chose ***Baseline*->*Report*** menu or click on  to create baseline report.

Test Baseline Processing Result

Control Baseline Quality

After the baseline is resolved, you can test the quality of the baseline by the quality standards such as RATIO, RMS and the point precision.

RATIO

The RATIO is the ratio of the less least RMS and the Least RMS after the integer ambiguity analysis, that is:

$$RATIO = \frac{RMS_{\sec}}{RMS_{\min}}$$

The RATIO reflects the reliability of the integer ambiguity parameter, which determined by a few factors. It has the relation to the observation quality and the observation term.

The RATIO is the key to reflect the quality of the baseline, generally, the RATIO is required to bigger than 1.8.

RMS

RMS is the Root Mean Square, that is:

$$RMS = \sqrt{\frac{V^T PV}{n-f}}$$

V is the residual of the observations;

P is the weight of the observations;

n-f is that the total numbers of observations subtracts to the number of known number.

RMS means the quality of the observations. The smaller the value of RMS is, the better the quality will be; otherwise the worse the quality. The RMS does not effected on by the observation terms.

According the theory of Symbolic Statistics Mathematical Statistics, the rate of the observation error within the 1.96 times RMS is 95%.

Point Precision

Point precision is an important standard of the internal accuracy of solution results. It is depend on line with the strength of the satellite geometry and RMS , it can be divided into the precision of horizontal direction, precision of the vertical direction, the baseline length precision and so on. The software will check the different accuracy standard according to tolerance setting of project.

Closed Loop and Repeat Baseline Testing

Closed Loop

1. The Definition of the Misclosure

The closed loop test is the useful way to confirm the quality of the baseline. The closed loop includes the synchronous loop, asynchronous loop and the duplicate baseline. In theory, the misclosure of the closed loop is zero, but in practice surveying a certain deviation is allowed. Please refer to the relation information about the deviation limit.

The types of the misclosure are as the followings:

✧ Component misclosure, that is :

$$\begin{cases} W_{\Delta X} = \sum \Delta X \\ W_{\Delta Y} = \sum \Delta Y \\ W_{\Delta Z} = \sum \Delta Z \end{cases}$$

✧ Total misclosure,that is:

$$W_s = \sqrt{W_{\Delta X}{}^2 + W_{\Delta Y}{}^2 + W_{\Delta Z}{}^2}$$

2. Synchronous closed loop

The misclosure of the closed loop is the misclosure of the closed loop formed by the observation baselines. Because the relativity among the baselines, so in theory the misclosure should be zero. If the deviation of the misclosure out of the limit, then there is at least one baseline vector is wrong. Instead, if the misclosure is within the limit, this mean that most static baselines are eligible, but that is not to say all the baselines of the loop is absolute eligible.

3. Asynchronous closed loop

The asynchronous closed loop is the closed loop formed by not all the synchronous baselines. The misclosure of the asynchronous loop is the asynchronous loop's misclosure. If the misclosure is within the limit of the deviation, it denotes the baseline vector to be eligible. If the misclosure is over the limit of the deviate, it denotes that at least a vector is not eligible. You can decide which baseline vector is not eligible by the vicinity asynchronous loop and the duplicate baselines.

Repeated Baselines

The observation result between two stations at different observation times is the repeat baselines. The difference between the repeat baselines is the repeat baselines comparability difference.

Identify Every Effect Factors

Effect Factors

Factors effecting on the baseline's result are as follows.

1. The setting starting coordinate is wrong when you process the baseline. The wrong starting coordinate will cause the baseline deviation in the scale and direction.

2. The too short observation time cannot decide the integer ambiguity of the satellite. And for the baseline processing, if the integer

ambiguity corresponding is not decided exactly, the baseline processing result will be effected.

3. The number of the cycle slips is too big in some time span and cause the cycle slips repairing is not perfect.

4. The multi-path effect is serious in an observation time span, and the corrections of the observation value are general big;

5. The effect on the troposphere and ionosphere is too serious;

6. The electromagnetic wave cannot be ignored.

7. The receiver itself has problem and cause the quality of the data too bad. e.g. the degraded phase accuracy of the receiver and the clock of the receiver is not accuracy.

Identify Effect Factors and the Answer Measures

1. The identification of the effect factors on the GPS baseline resolution

1) In the effect factors, some are easy to distinguish, such as the too short observation time, too many cycle slips, serious multi-path effect and too big effect from the troposphere or ionosphere. But other factors are not easy to distinguish, such as the inaccurate starting coordinate.

2) The inaccurate starting coordinate

Now we cannot distinguish easily the effect of inaccurate starting coordinate to the quality of the baseline solution. So we should improve the accuracy of the beginning coordinate to prevent this effect.

3) The identification of the short observation time span

You can distinguish this question easily. You can view the number of each satellite's observations in the record files. The HGO Software Package supplies the visible satellite map.

4) The identification of many cycle slips

You can analyze the observation residual of the baseline solution to distinguish the cycle slips. Now most baseline processing software use the dual-difference value, so when the observations include the uncorrected cycle slips, all the residual of the dual-difference corresponding to the cycle slips will have the obviously increase at several times.

5) The Identification of the serious multi-path effect and the too much effect of the troposphere or the ionosphere refraction

To the multi-path effect and the refraction of the troposphere or the ionosphere, we distinguish them by the residual of the baseline, too. But different to the integer cycle slips, when the multi-path effect and the refraction effect of the troposphere or the ionosphere serious, the residual increase within one time not several times and obviously bigger the normal residual.

2. Answer measures

1) The answer measures of the inaccurate starting coordinate

To the inaccurate of the starting problem, you can use the most precise point as the starting point when you process the baseline. The relative accurate starting coordinate can be got by the long time point positioning or connecting with the more accurate the WGS-84 coordinate, or do as the following way :

When you resolve the baseline in a network, chose one point's coordinate as the derivation of all the points' coordinate, so it is the baseline's starting coordination, then all the baselines have the same system error, so you can introduce the system parameter to resolve it during the network adjustment.

2) The answer measures to the too short observation time

If the observation time is too short, you can delete their observations. So you can improve the result of the solution via preventing them from solution.

3) The answer measures to too many cycle slips

If in an observation time span, many satellites often have cycle slips, you can delete this time span to improve the solution quality. If only one or two satellites have too many cycle slips, you can delete this satellite to improve the solution quality.

4) The answer measures to the serious effect of the multi-path

The result of the multi-path effect is the observation value residual too big, so you can delete the big residual observation value by reducing the edit dilution. Or you can delete the observation time or the satellite effected on serious by the multi-path.

5) The answer measures to the serious effect of the troposphere or the ionosphere refraction:

- ✧ Increase the elevation cutoff angel and delete the data of little elevation angel which is easy effected on by the refraction. But this method is blindly, because the signal of little elevation angle may not be effected mostly.
- ✧ Modify the delay of the troposphere or the ionosphere by the model
- ✧ If the observation value is dual-frequency, you can use the value without the fraction of the ionosphere.

The Residual Map

The residual map is a useful tool to condense the baseline processing. When you process a baseline, it is often to distinguish the factor of effect the solution or which satellite or in which observation time span has problem, the residual map is useful to this task. The baseline residual map is a figure expressing the residual of the observations. Chose the ***Previous*** or the ***Next*** , you can view the residual of the combination of each dual-difference. See Figure 5-8.

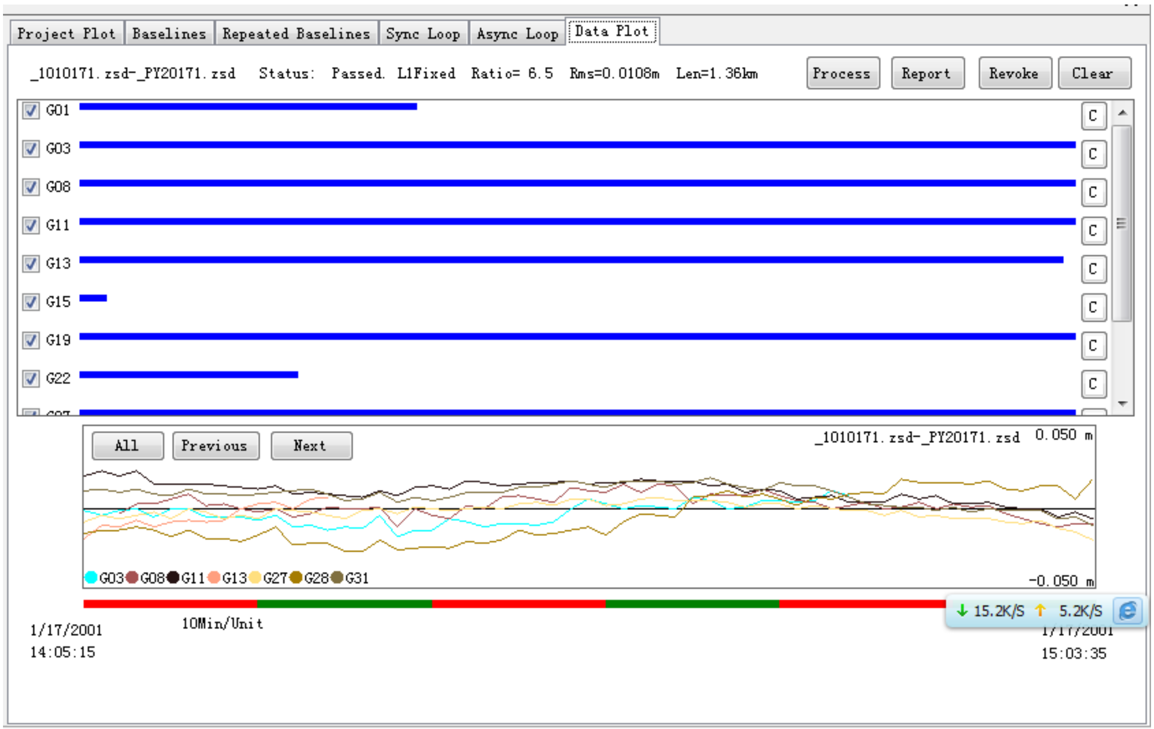


Figure 5-8

This picture is a common format of the baseline residual map. The horizontal axes displays the observation time, the vertical axes displays the observation value residual.

The residual value fluctuates with the zero axes in the common residual map, and the amplitude within 0.1 cycle.

Reprocess a Baseline

After you find the effect factors to the baseline's quality, you can reprocess this baseline through correcting the baseline processing setting or editing the observation time span of the baseline.

In the observation map, you can drag the mouse to select the deleted data. See Figure 5-9, the data in the broken lines box will be shielded, and will not be processed.

Figure 5-9

When you find the processing is disqualified during the baseline surveying, you need correct the setting of the baseline or edit the observation time span. If you cannot get the qualified solution still, you should prevent this baseline from the network adjustment of delete this baseline. If the baseline is necessary in the control network, you should resurvey this baseline.

Dynamic Route Processing

The dynamic route post-processing is the post-difference data processing. The post-difference is different with the Real Time Kinematic which can get the surveying result at once, while the post-difference cannot get the result until the inner processing. If the post-difference processing cannot get the qualified result from the observations processing, there will be trouble. So the quality of the post processing software effects on the reliability and the quality of the post difference.

The operation of dynamic route post-processing is very easy, just do it as dynamic route processing section of quick start guide chapter. Here we are not repeatedly introduced.

CHAPTER

6

Network Adjustment

Introduction:

- Function and Steps of Network Adjustment
- Network Adjustment Preparation
- Run Network Adjustment

After you process the baseline, you should test again the result of the processing, optimize the result, and transform the coordinate to the needed national coordinate or the local coordinate, which is the content of the network adjustment. The method of this software network adjustment is the Least Square method.

Function and Steps of Network Adjustment

The Software has the function of processing the free network adjustment, the 3D constrained adjustment, the 2D constrained adjustment and the height fitting.

See Figure 6-1, for the basic network adjustment steps for the HGO Software Package, from the map you can find that the network adjustment including three procedures.

- ✧ The preparations done by the user. That is you need set up the coordinate, enter the latitude and longitude, the coordinate, the elevate of the known points;
- ✧ Process the network adjustment which is done by the software;
- ✧ The analysis and control to the quality of the processing result which are done by the user. Figure 6-1 The procedure of the network adjustment：

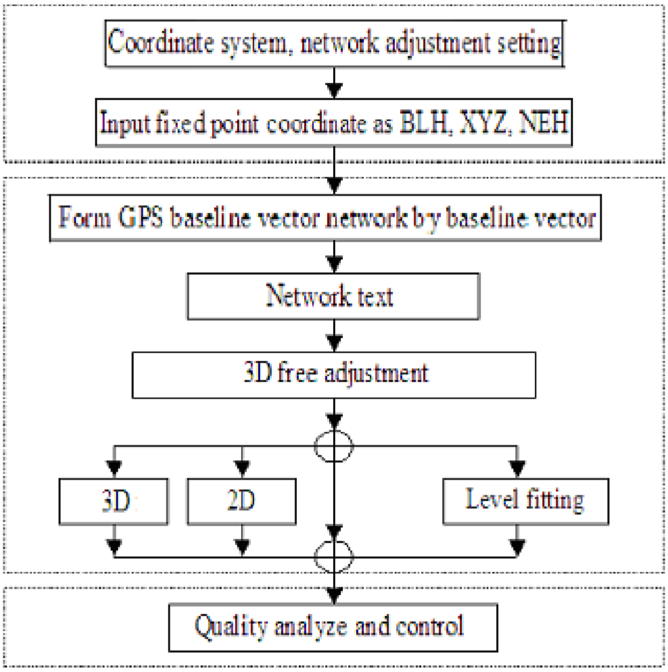


Figure 6-1

We can find that, the software only achieves the solution of the network adjustment, what is more important is the attendance of the user and getting a right result. And this is often a procedure again and again.

Network Adjustment Preparation

Coordinate Setting

You should check the setting of the coordinate before set up the network adjustment. The details of setting coordinate system, please reference Set the coordinate Parameters section of Project Management chapter.

Network Adjustment Setting

Chose ***Adjust*** /***Adjust options*** menu or click on  in the navigation field, the following dialog will display as Figure 6-2, you can set adjustment parameters and test parameters.

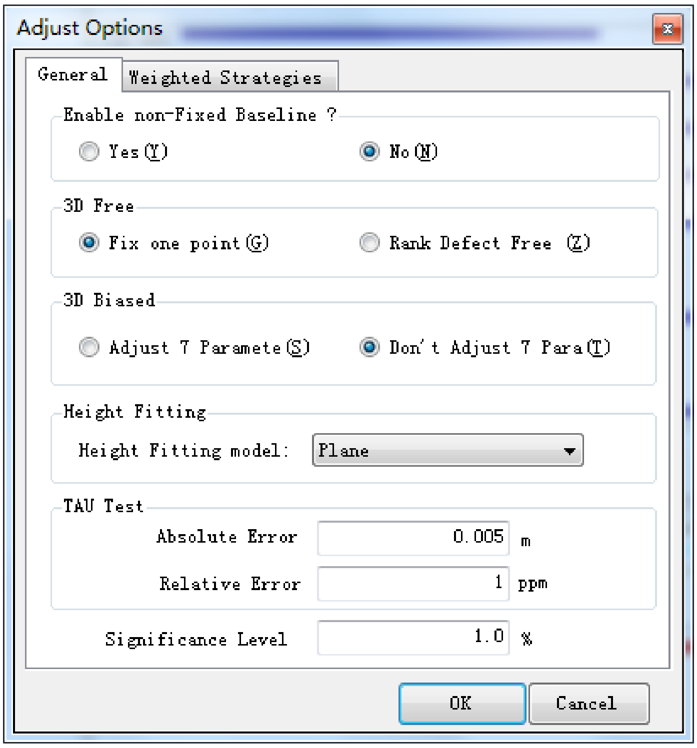


Figure 6-2

Control-point Coordinates

After network adjustment setting, you need to enter control-point coordinate, or you cannot do constrainted adjustment. There are several methods to enter the control-point coordinate:

1. Click on ***Set as Control Point*** in the pop-up menu of sites list to set the site to control point.

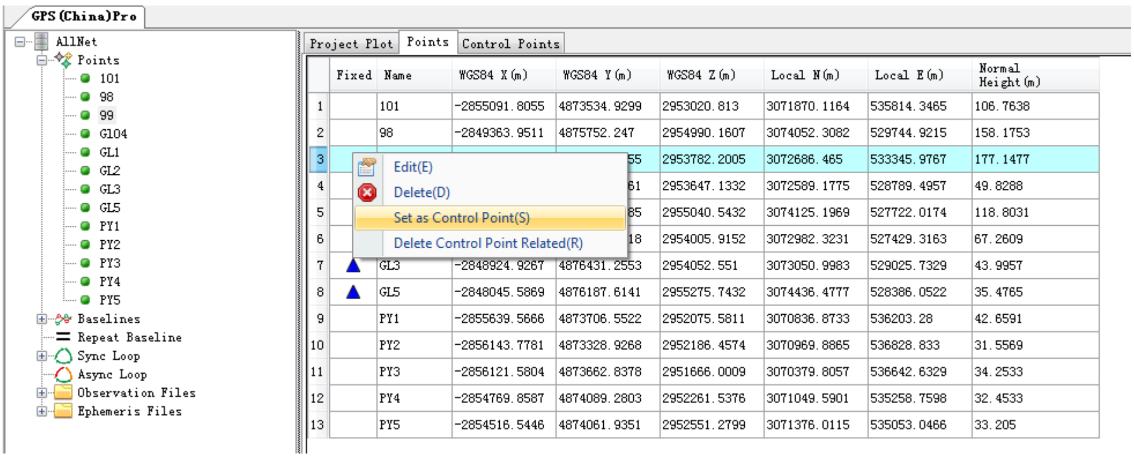


Figure 6-3

2. Click on ***Set as Control Point*** in the pop-up menu of control point list to enter the control point info.

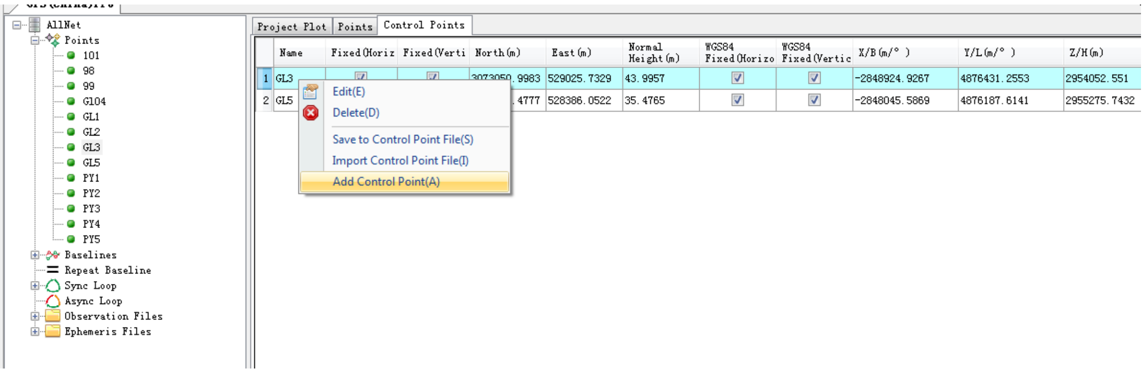


Figure 6-4

3. Click on ***Import Control Point File*** in the pop-up menu of control point list to import the existing control point file to the project.

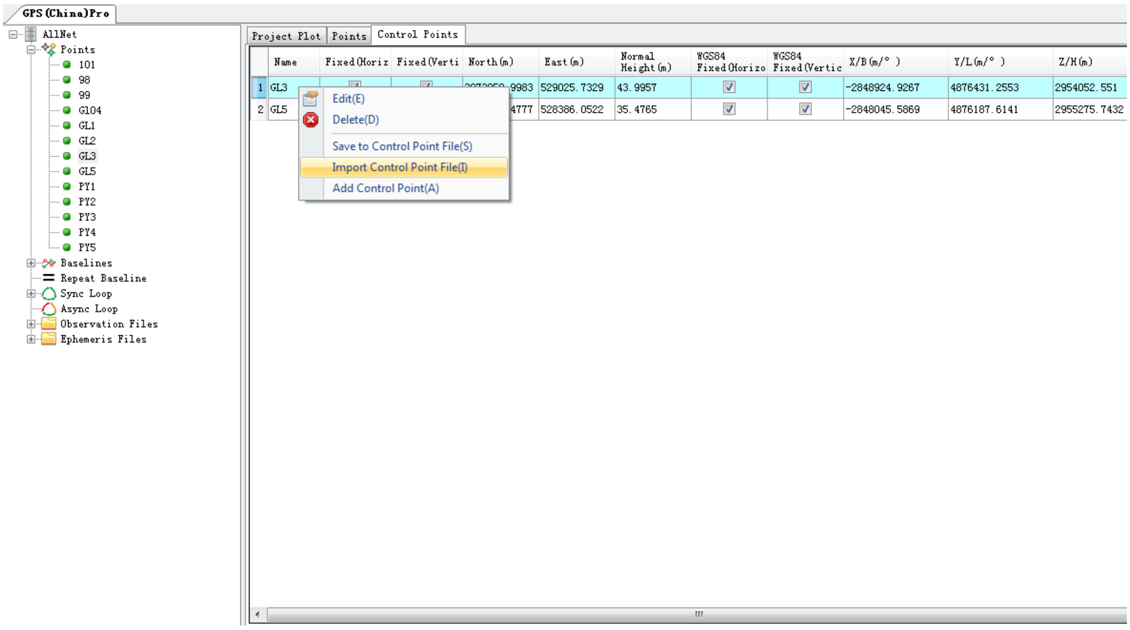


Figure 6-5

After entering control point info, you can click on ***Save to Control Point File*** in the pop-up menu of control point list to save control point file .

Run Network Adjustment

Run Adjust in the Adjust menu, or you can click on  button in the navigation field. Generally, just choose ***auto*** adjust mode, the software will process network adjustment based on the known baseline processing result, the network adjustment setting, the observation point's coordinate. After adjustment, the software will form the adjustment results list, select an adjustment result, then click on Report, you can view the correspond adjustment report.

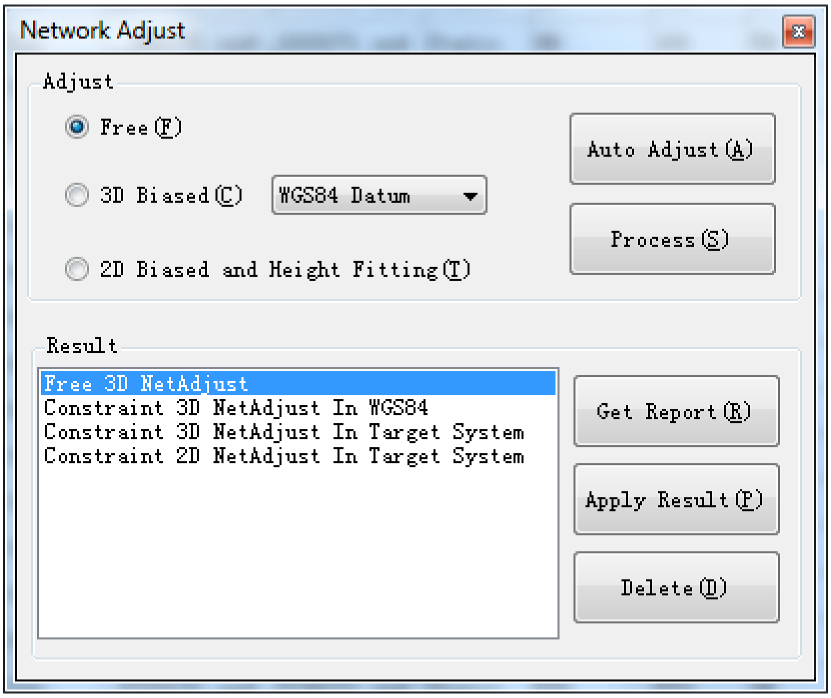


Figure 6-6

Get Baseline Vector Network

The first step to run the network adjustment is getting the baseline vector network. The principle to form the vector is as the following:

1. This baseline in this project and it is not be deleted;

2. This baseline with the starting name and the calculation name;

3. Have resolved this baseline and display the qualified baseline in the vector list ;

4. This baseline is not set up to not attend the solution and the network adjustment.

The baseline with the above items will be downloaded in the first step of the network adjustment and form a baseline vector network.

Check Connectivity of Baseline Vector Network

If you process the adjustment with the network not connective, then the result of the adjustment can not converge. So the software will test the connectivity of the network automatically before the adjustment. If the map is not connective, you will find the message information as Figure 6-7:

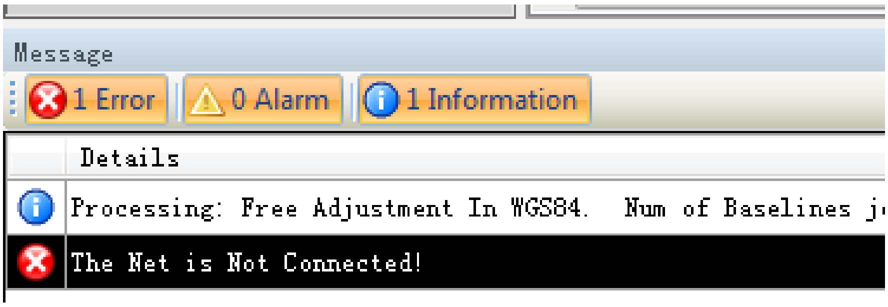


Figure 6-7

So you should test the baseline vector, the observation point name of the baseline vector network. The step to check as the following

1. Firstly, check the map is divided into how many parts and it has the separated observation sites or baseline or not, if it has, you should delete the separate point or process baseline respectively.

2. Secondly, make sure the key baseline is resolved successfully, and it is not prevented from the network adjustment. You should reprocess or resurvey the key baseline if it is in the above situation.

3. Thirdly, make sure no observation site with two difference names, which reflecting to the map is that a site is too near to the other site. Because this two point observation is observation of the same site at different time span, so they can not form a baseline and the map is not connective, the answer measure is to modify the error station name in the observations property.

Adjustment Report

The results of the adjustment will be reflected in the report, Adjustment report content and display form can be set in the Adjust Report Options window (Figure 6-8).A free network adjustment, for example, to get the Web version of the adjustment results are as Figure 6-9.

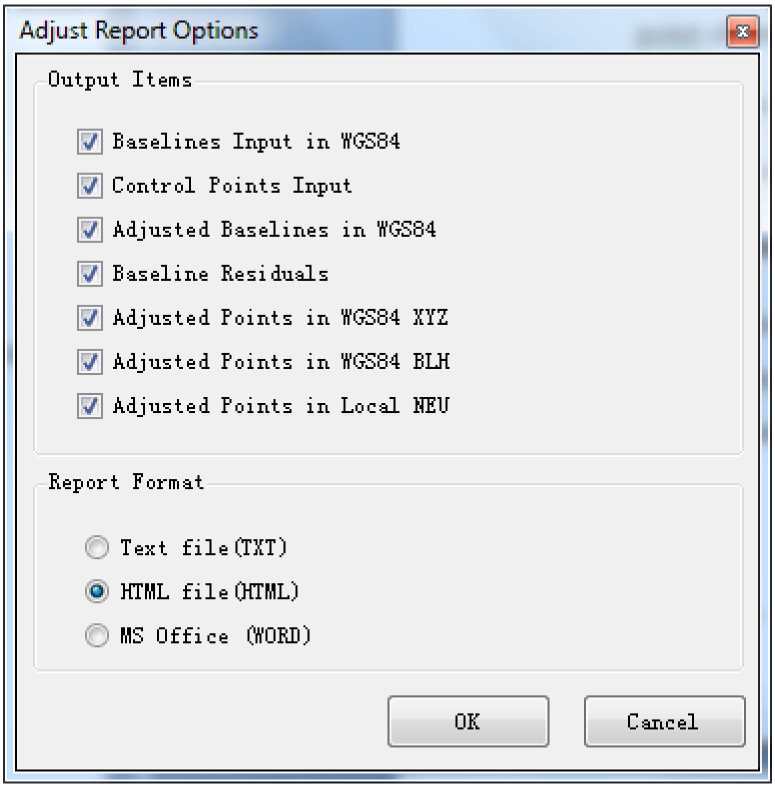
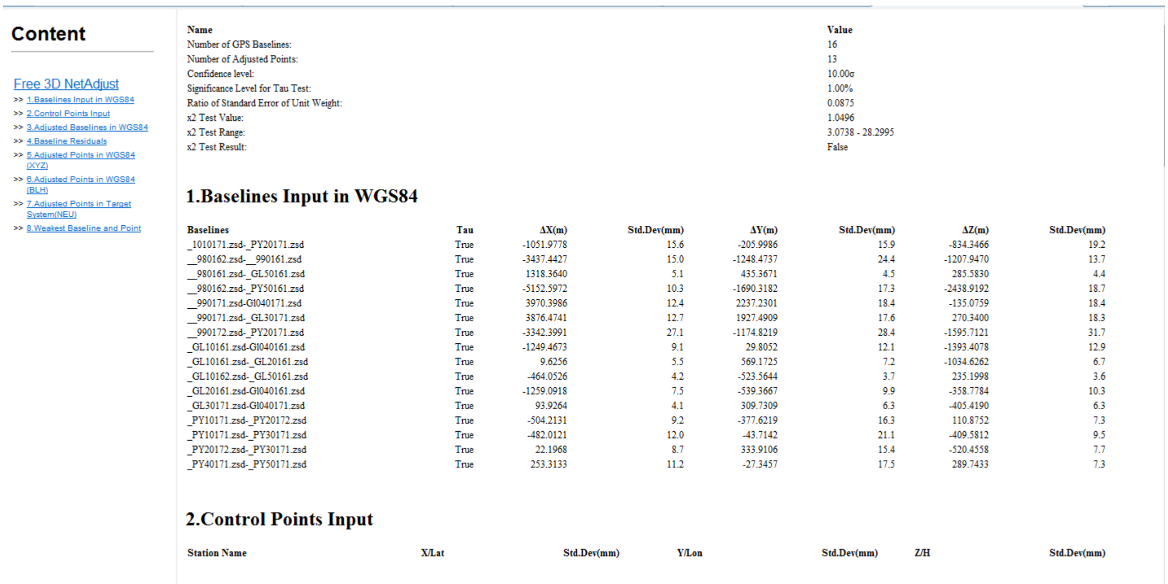


Figure 6-8



Content

Free 3D NetAdjust
>> 1.Baselines Input in WGS84
>> 2.Control Points Input
>> 3.Adjusted Baselines in WGS84
>> 4.Baseline Residuals
>> 5.Adjusted Points in WGS84 (XYZ)
>> 6.Adjusted Points in WGS84 (BLH)
>> 7.Adjusted Points in Target System(NEU)
>> 8.Weakest Baseline and Point

Name	Value
Number of GPS Baselines:	16
Number of Adjusted Points:	13
Confidence level:	10.00σ
Significance Level for Tau Test:	1.00%
Ratio of Standard Error of Unit Weight:	0.0875
x2 Test Value:	1.0496
x2 Test Range:	3.0738 - 28.2995
x2 Test Result:	False

1.Baselines Input in WGS84

Baselines	Tau	ΔX(m)	Std.Dev(mm)	ΔY(m)	Std.Dev(mm)	ΔZ(m)	Std.Dev(mm)
_1010171.zsd-_PY20171.zsd	True	-1051.9778	15.6	-205.9986	15.9	-834.3466	19.2
__980162.zsd-__990161.zsd	True	-3437.4427	15.0	-1248.4737	24.4	-1207.9470	13.7
__980161.zsd-_GL50161.zsd	True	1318.3640	5.1	435.3671	4.5	285.5830	4.4
__980162.zsd-_PY50161.zsd	True	-5152.5972	10.3	-1690.3182	17.3	-2438.9192	18.7
__990171.zsd-Gl040171.zsd	True	3970.3986	12.4	2237.2301	18.4	-135.0759	18.4
__990171.zsd-_GL30171.zsd	True	3876.4741	12.7	1927.4909	17.6	270.3400	18.3
__990172.zsd-_PY20171.zsd	True	-3342.3991	27.1	-1174.8219	28.4	-1595.7121	31.7
_GL10161.zsd-Gl040161.zsd	True	-1249.4673	9.1	29.8052	12.1	-1393.4078	12.9
_GL10161.zsd-_GL20161.zsd	True	9.6256	5.5	569.1725	7.2	-1034.6262	6.7
_GL10162.zsd-_GL50161.zsd	True	-464.0526	4.2	-523.5644	3.7	235.1998	3.6
_GL20161.zsd-Gl040161.zsd	True	-1259.0918	7.5	-539.3667	9.9	-358.7784	10.3
_GL30171.zsd-Gl040171.zsd	True	93.9264	4.1	309.7309	6.3	-405.4190	6.3
_PY10171.zsd-_PY20172.zsd	True	-504.2131	9.2	-377.6219	16.3	110.8752	7.3
_PY10171.zsd-_PY30171.zsd	True	-482.0121	12.0	-43.7142	21.1	-409.5812	9.5
_PY20172.zsd-_PY30171.zsd	True	22.1968	8.7	333.9106	15.4	-520.4558	7.7
_PY40171.zsd-_PY50171.zsd	True	253.3133	11.2	-27.3457	17.5	289.7433	7.3

2.Control Points Input

Station Name	X/Lat	Std.Dev(mm)	Y/Lon	Std.Dev(mm)	Z/H	Std.Dev(mm)

Figure 6-9

Test Network Adjustment Result

You should check the result of the network adjustment after the adjustment. You should test the corrections, the mean square error and the corresponding data statistics result to evaluate the quality of the network adjustment.

The net adjustment of mathematical statistics test includes the X2 test and Tau Detesting.

X2 test showed the reliability of the results of adjustment. If the X2 test value is less than the theoretical value range, it indicates that adjustment results of the error is smaller than the theoretical error. That is , the adjustment results are better than imagined, and generally, do not need to deal with or select the appropriate "baseline standard deviation confidence level (relaxation factor) to make the X2 test qualified; If the X2 test value is greater than the theoretical value range, the error of the adjustment results exceed the allowable range, it should be the baseline solver of error is too large or the control point information has the existence of gross errors, you should find the problem with baseline or control points, and process again until test passed.

Tau test is used to test the existence of gross errors gross error in the baselines involving adjustment. Generally, the test result depends on every baseline corrections. If a baseline Tau test cannot be passed, you need to process baseline again and then make it participate in the adjustment, or disable the baseline directly.

If the result of the network is disqualified, you can find the cause from the following aspects.

1. Make sure the coordinate setting is right;

2. Make sure the known point is correct and in the same system;

3. Make sure the baseline vector map is correct. For a disqualified static baseline, you can prevent it from network adjustment. If this baseline cannot be deleted or is very important in the baseline network, so you need resolved this baseline again or necessarily to resurvey again;

4. Make sure the observation site and antenna height is correct in the observation files. If it is wrong, the misclosure or the result of the free network adjustment is very bad.

Of course, you can delete the bad quality observations directory. Because duplicate baseline to this deleted line can be found when do network adjustment, without the deleted baseline, the structure of the network is not effected on. After you delete and reprocess the baseline, you will get the same qualified result.

Commonly if the map is qualified and the baseline solution accord with the standard requirements, it can pass two tests and complete successfully the 3D free adjustment.

CHAPTER

7

Report

Introduction:

- Static Baseline Processing Report
- Network Adjust Report
- Dynamic Route Processing Report

In this chapter, we will introduce the detail context of various reports.

Static Baseline Processing Report

The static processing report consists of reference, rover, processing controls, tracking, baseline solution, ambiguities.

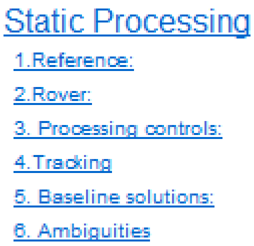


Figure 7-1

Reference and Rover Info

It records the reference point/rover info, such as name, code, the spatial rectangular coordinate under WGS84 coordinate system, geodetic coordinate under WGS84 coordinate system, receiver info and Antenna info.

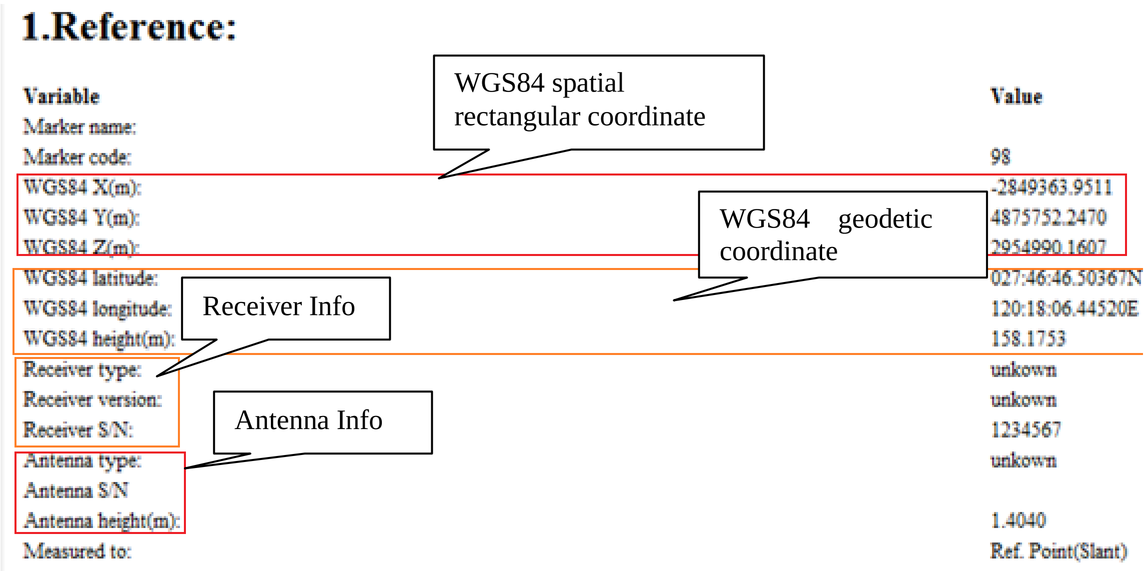


Figure 7-2

Processing Control

This part mainly record the observation start time of baseline and end time some processing control parameters which you set in the procession options window.

Ambiguities

This part records the status of integer ambiguities solution, such as the following figure:

float ambiguity summary(L1)

System	SVID	Week	Seconds	Interval	Float
GPS	28	1097	200365	900	616828.8255
GPS	19	1097	200365	3060	728840.2383
GPS	31	1097	200365	4740	548507.8070
GPS	8	1097	200365	5760	-291432.8050
GPS	2	1097	201385	4740	-834005.8204
GPS	20	1097	202045	4080	-571803.9298
GPS	7	1097	203125	3000	2139850.2347

fixed ambiguity summary(L1)

System	SVID	Week	Seconds	Interval	Fixed	Ra
GPS	28	1097	200365	900	616829	
GPS	19	1097	200365	3060	728840	
GPS	31	1097	200365	4740	548508	

Figure 7-3

Network Adjustment Report

This report is generated by network adjusting. Here we just introduce one report with free adjustment method.

Free 3D NetAdjust

>> 1.Baselines Input in WGS84
>> 2.Control Points Input
>> 3.Adjusted Baselines in WGS8
>> 4.Baseline Residuals
>> 5.Adjusted Points in WGS84 (XYZ)
>> 6.Adjusted Points in WGS84 (BLH)
>> 7.Adjusted Points in Target System(NEU)
>> 8.Weakest Baseline and Point

Figure 7-4

The header of report is the result of adjustment test. You can know the adjustment result by these values. For example the test result in the following figure, it is obvious that the X2 Test result is not in the range, it is not passed. When the x2 Test value is false, you need to check the baseline according to above chapter.

Name	Value
Number of GPS Baselines:	21
Number of Adjusted Points:	13
Confidence level:	10.00σ
Significance Level for Tau Test:	1.00%
Ratio of Standard Error of Unit Weight:	0.3949
x2 Test Value:	10.6616
x2 Test Range:	11.8076 - 49.6449
x2 Test Result:	False

Figure 7-5

If the result of the network is disqualified, the baseline of problematic vector will be highlighted in red as Figure 7-6. You need to check the baseline according to above chapter.

3.Adjusted Baselines in WGS84

Baselines	Tau	ΔX(m)	Std.Dev(mm)	ΔY(m)
_1010171.zsd-_PY20171.zsd	True	-1051.9830	8.6	-205.9945
__980162.zsd-__990161.zsd	True	-3437.4406	5.0	-1248.4660
__980161.zsd-_GL10162.zsd	True	1782.4153	2.5	958.9313
__980161.zsd-_GL50161.zsd	True	1318.3638	2.5	435.3672
__980162.zsd-_PY50161.zsd	False	-5152.6008	5.4	-1690.3245
__990172.zsd-_1010171.zsd	False	-2290.4346	9.9	-968.8154
__990171.zsd-GI040171.zsd	True	3970.4021	4.6	2237.2396
__990171.zsd-_GL30171.zsd	True	3876.4791	4.8	1927.4921
__990172.zsd-_PY20171.zsd	False	-3342.4162	7.8	-1174.8054
__990161.zsd-_PY50161.zsd	True	-1715.1489	5.9	-441.8211
_GL10161.zsd-GI040161.zsd	True	-1249.4680	3.7	29.8029
_GL10161.zsd-_GL20161.zsd	True	9.6257	3.1	569.1717
_GL10162.zsd-_GL50161.zsd	True	-464.0525	2.3	-523.5645
_GL20161.zsd-GI040161.zsd	True	-1259.0915	3.7	-539.3677
_GL30171.zsd-GI040171.zsd	True	93.9269	2.5	309.7310
_PY10171.zsd-_PY20172.zsd	True	-504.2149	4.6	-377.6186
_PY10171.zsd-_PY30171.zsd	True	-482.0105	5.4	-43.7139

Figure 7-6

Dynamic Route Processing Report

It is a dynamic route processing report. There are three types report: RTD report, Stop&Go report and PPK report. The context of whole report is very clear. RTD report includes three parts: Reference point info, Coordinate system parameters and the every point info of rover. And the stop&go report and PPK report has stop point info besides RTD report context.

CHAPTER

8

Import and Export

Introduction:

- Import and Export Observations and Ephemeris
- Export the Coordinate of Result Point
- Export Network Map
- Export Baseline Result
- Export Report

From the above chapters, it is obviously that the HGO Software Package has the strong function but simple operations. In this chapter, we will introduce the import and export function of the software.

The HGO Software Package now can supply the abundance function of the import and export. Commonly, the output part content will be hand in, as a part of the result, when you hand in the result text.

Import and Export Observations and Ephemeris

For imported observations, we can convert them to RENIX file by choosing ***Convert to RINEX*** item in the pop-up menu (Figure 9-1).

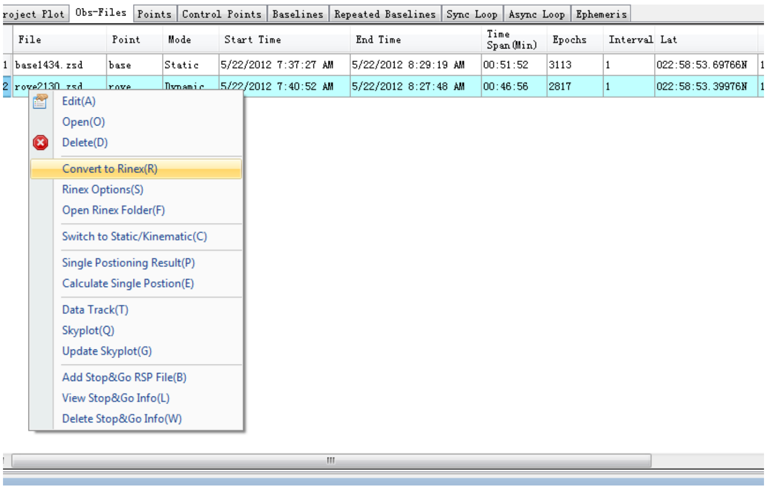


Figure 8-1

You can select  in the navigation to batch conversion (Figure 8-2). The export achievements are in the "Rinex" folder under project folder.

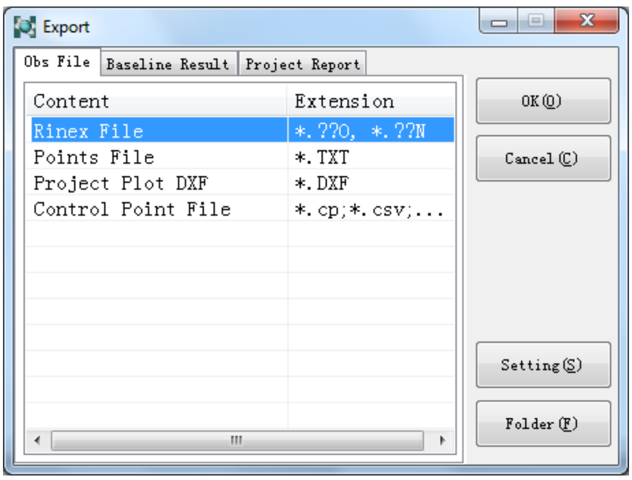


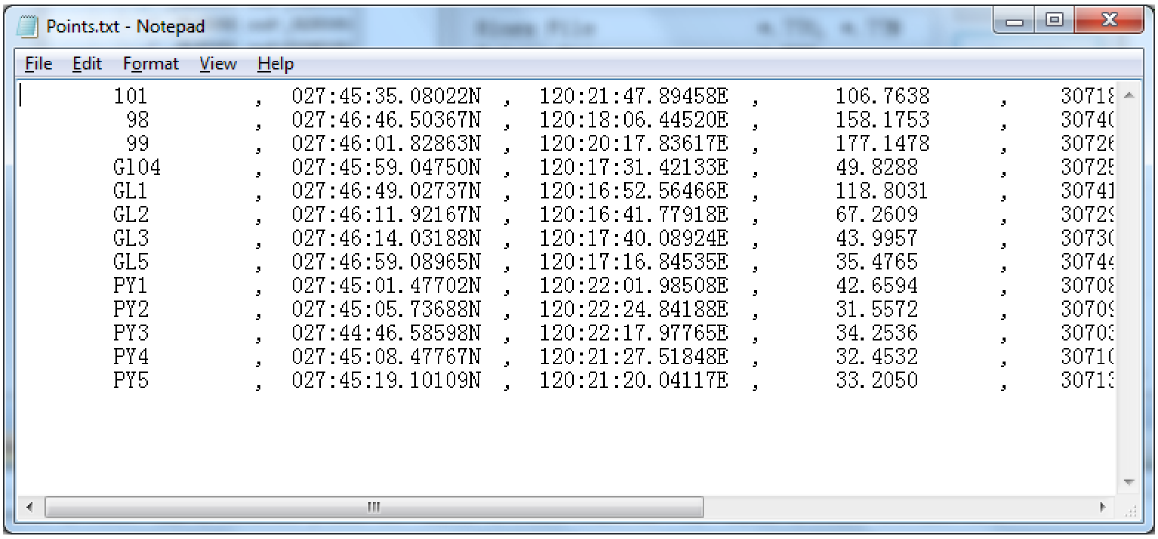
Figure 8-2

Export the Coordinates of Result Points

In above window, chose ***Points Files*** item to export. You can get the coordinate of result point of TXT format.

The coordinate of point is separated by ‘,’ symbol:

Point name, Latitude, Longitude, Ellipsoidal Height, Northing, Easting, Normal Height



101	027:45:35.08022N	120:21:47.89458E	106.7638	3071
98	027:46:46.50367N	120:18:06.44520E	158.1753	3074
99	027:46:01.82863N	120:20:17.83617E	177.1478	3072
G104	027:45:59.04750N	120:17:31.42133E	49.8288	3072
GL1	027:46:49.02737N	120:16:52.56466E	118.8031	30741
GL2	027:46:11.92167N	120:16:41.77918E	67.2609	3072
GL3	027:46:14.03188N	120:17:40.08924E	43.9957	3073
GL5	027:46:59.08965N	120:17:16.84535E	35.4765	3074
PY1	027:45:01.47702N	120:22:01.98508E	42.6594	3070
PY2	027:45:05.73688N	120:22:24.84188E	31.5572	3070
PY3	027:44:46.58598N	120:22:17.97765E	34.2536	3070
PY4	027:45:08.47767N	120:21:27.51848E	32.4532	3071
PY5	027:45:19.10109N	120:21:20.04117E	33.2050	3071

Figure 8-3

Export Network Map

HGO software package can export Network Map with DXF format. Chose ***Project Plot DXF*** item to export Network Map .

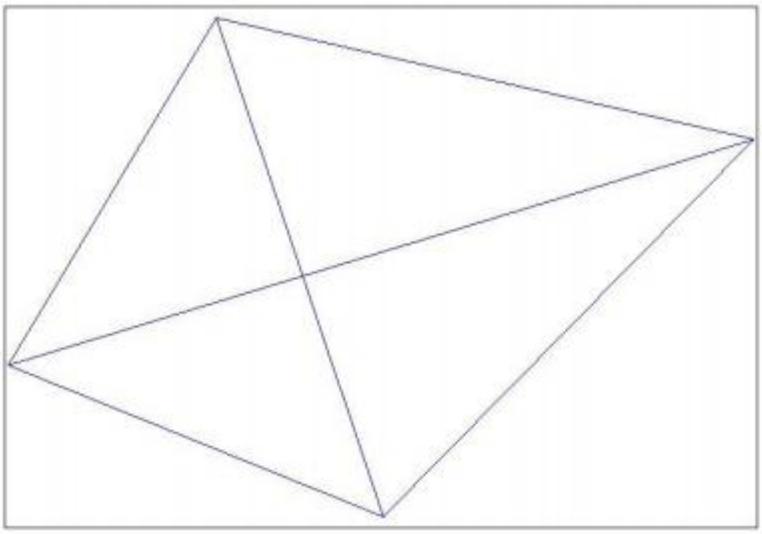


Figure 8-4

Notice: If use CAD software open can't see graphics, is perspective needs to adjust, please type the command e, z in CAD software, it will automatically zoom to effective graphics view area.

Export Baseline Result

HGO software package can export baseline result as Figure 8-5. After exporting, click on ***Folder*** button, you can view the corresponding format baseline result.

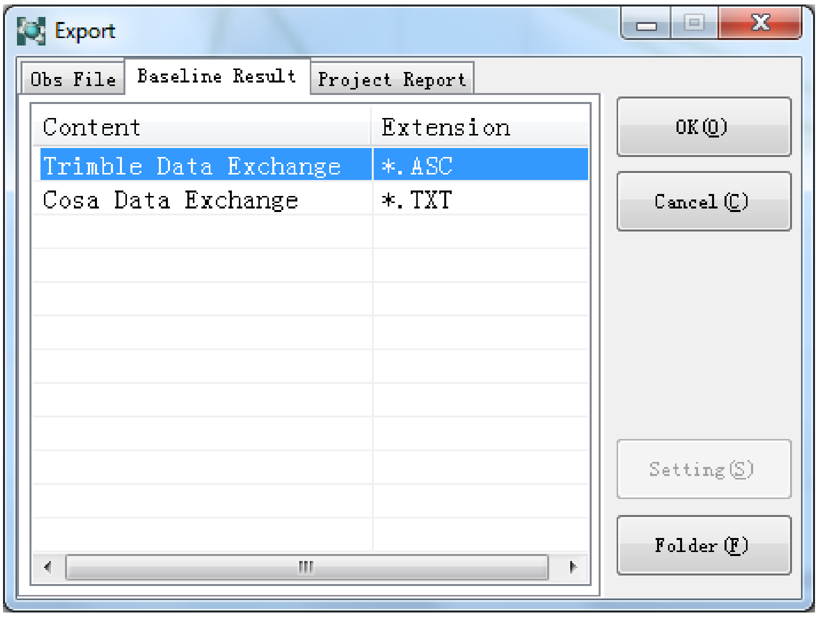


Figure 8-5

Export Report

HGO software package can export project report with format: TXT, DOC, HTML

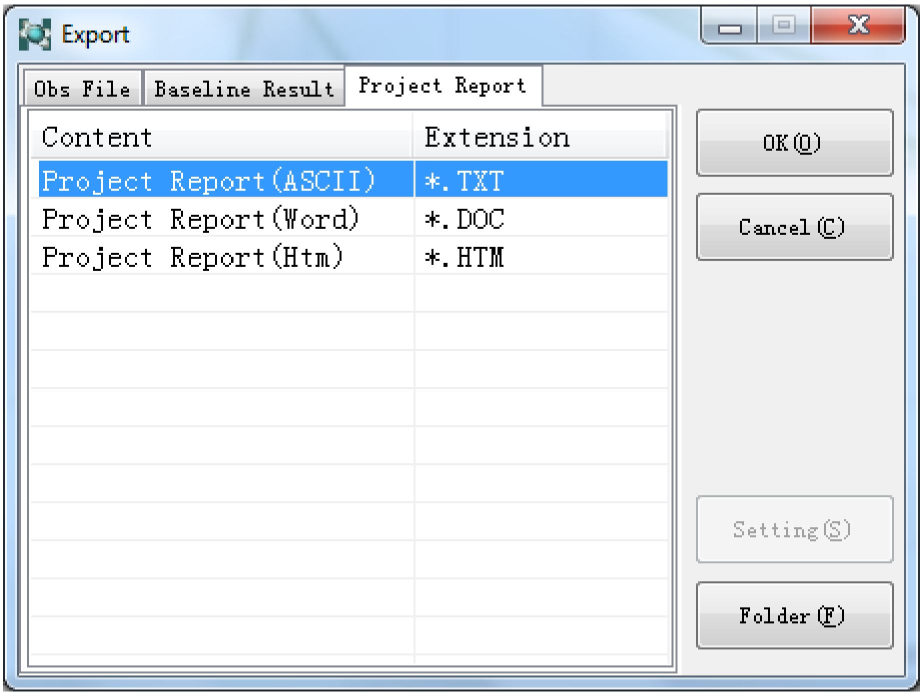

Export
Obs File
Baseline Result
Project Report
Content
Extension
Project Report(ASCII)
*.TXT
Project Report(Word)
*.DOC
Project Report(Htm)
*.HTM
OK(O)
Cancel(C)
Setting(S)
Folder(F)

Figure 8-6

CHAPTER

9

Using of Tools Software

Introduction:

- Usage of Antenna Manager
- Coordinate Transformation Tool
- Satellite Prediction Software
- Precise Ephemeris Download Tool

The Common tools software of the HGO Data Processing Software Package include the antenna manager, the satellite prediction software, the Coordinate transformation tool, and the Precise ephemeris download tool.This chapter mainly introduces the using method and the answer to the common question. If you select All Install while install the software, the above tools software will be installed in the Bin directory of the software, and supplies the shortcut method.

Usage of Antenna Manager

Antenna manager is designed for updating and editing the receiver parameter file(The "HitAnt. Ini" file). When you used the unknown receiver type but know the geometric parameter of the receiver and the phase center height parameters, you can use this tool to add the receiver you needed.

Chose ***Tools***-> ***Receivers*** in the menu, there will be pop-up window, in the ***Antenna*** item, you can set up some commonly used parameters here, such as the radius, the phase center height. See Figure9-1:

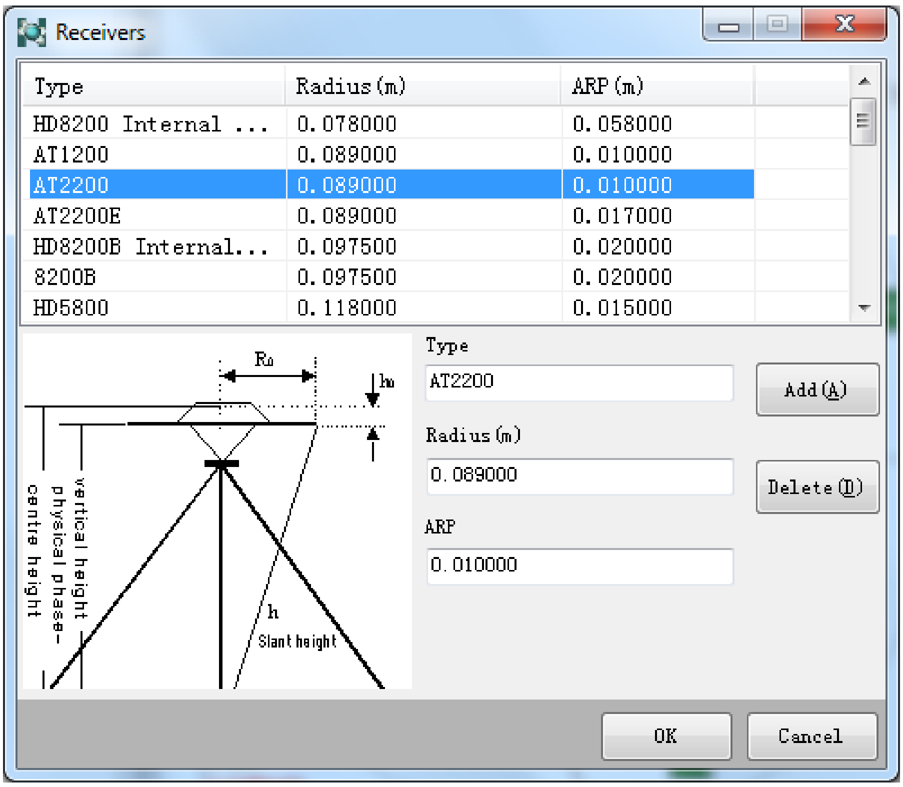


Figure 9-1

In the list window, chose the name of the antenna, you can change the corresponding parameters direct.

Notice: This file would influence the data achievement, please don't change it easily!

Coordinate Transformation Tool

The HGO Data Processing Software Package supplies the coordinate transformation tool. Choose ***Coord Tool*** in the ***Tools*** menu to function the coordinate transformation tool.

This software can transform between the local coordinate and the WGS84 coordinate, meanwhile it can calculate the parameter. The following is about these tools in details:

Summarize

Firstly, you should know the representation of each coordinate. The common methods are the Longitude-Latitude and Ellipsoid Height (BLH), the Space Rectangular Coordinate (XYZ), the Plane Rectangular Coordinate and the Geoidal Height (xyh/NEU). The ellipsoid height is a geometric sense and the geoidal height is a physical quantity.

The WGS84 is of the BLH system, the Beijing 54 is of the Plane Rectangular Coordinate.

Now it comes to the accuracy of the transformation. In an ellipsoid, the transformation is rigor(BLH--XYZ), but the transformation in different ellipsoid is not rigor. e.g. There is no a transformation parameters can be used all over the national between the WGS84 coordinate and the Beijing 54 coordinate, because the WGS84 coordinate is a geocentric coordinate system, but the Beijing 54 coordinate is a local geodetic reference system. The elevation's transformation is between geoidal height and physical quantity. So in each place must use local ellipsoid fitting, usually with seven parameter model to fitting.

Generally, the more rigor method to transform coordinate between different ellipsoid is the seven parameters transformation. That is the X plane, the Y plane, The Z plane, the X Spin, the Y spin, the Z spin and the Scale Dilution K. For getting the seven parameters in a location, you should have more than three points. If the area is not large, the furthest point is within 30km, and you can use the three parameters, that is X plane, the Y plane, and the Z plane. The X spin, the Y spin, the Z spin and the Scale Dilution K are regards to be zero. The tree parameters are the special of the seven parameters.

The essence of the seven parameter model with a local ellipsoid to fitting the form of local coordinate system; so the local ellipsoid height after transformation is the geoidal height. Of course, we can also fit it in the different direction of plane and elevation. For example, using the four parameter model fitting in the plane, and using the secondary surface model fitting in the elevation direction. This mode of handled separately is more freedom than seven parameter model. But because the four parameters model has less parameter, a weak ability of expression, usually uses for small regional coordinate transformation.

To sum up, the HGO coordinate transformation tool provides two practical transformation strategies to choosing by the customers:

1. Seven parameter model, one step to get local plane and level data.

2. Four parameters and elevation fitting model, which is divided into two steps to get local plane and level data.

Because each company has a different definition of the model and process, here is our company's conversion process, its description as follows:

- ✧ the conversion process of seven parameters model is like this:

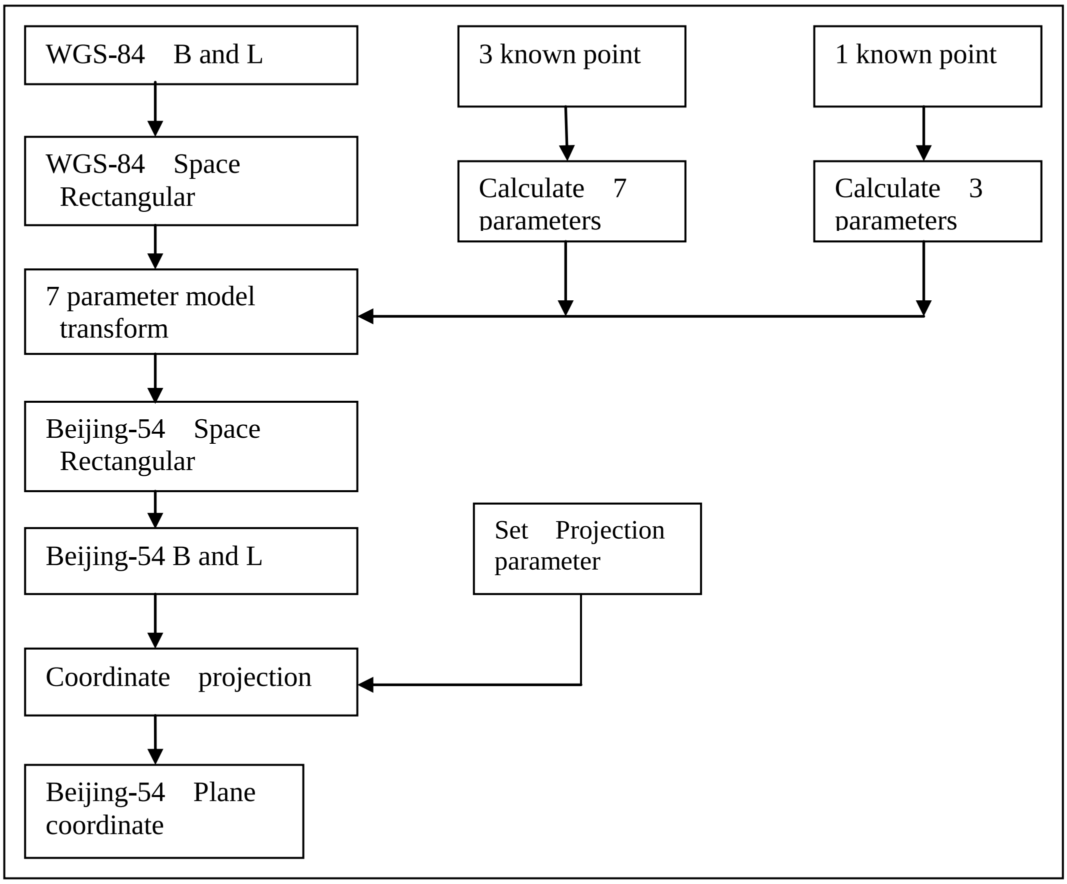


Figure 9-2

✧ the conversion process of four parameters model is like this:

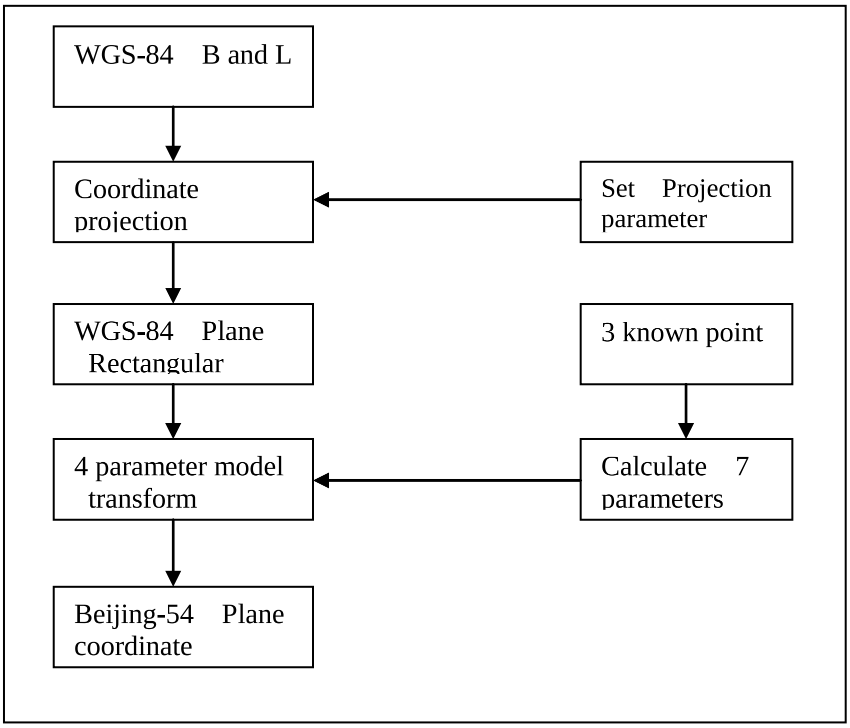


Figure 9-3

✧ the conversion process of elevation fitting is like this:

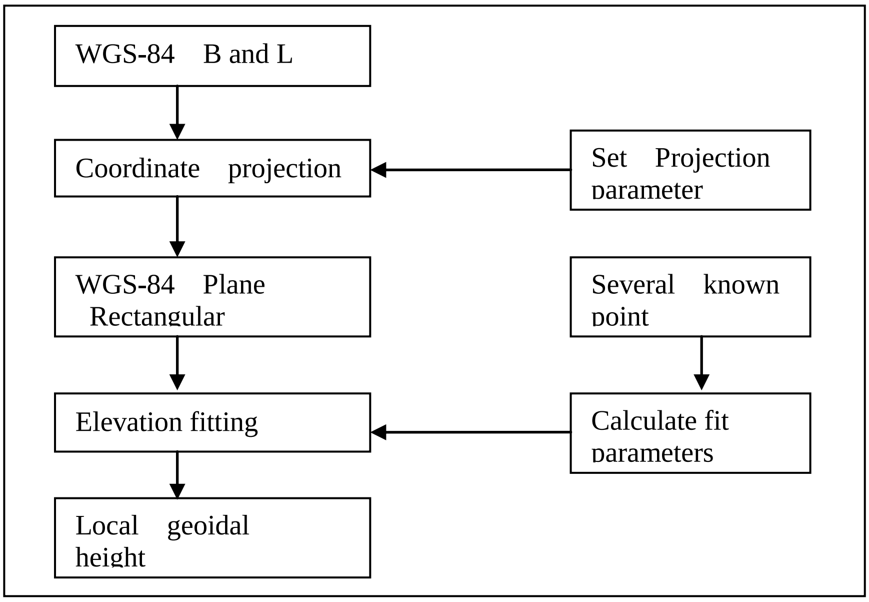


Figure 9-4

Use Software to Transform Coordinate

This software manages the coordinate transformation parameters with file(*.dam), you can save a group of transformation parameters as a file, and next time you can open this file to transfer the parameters in the file menu.

Involves the coordinate transformation parameters are generally refers to the ellipsoid parameter, projection parameters, seven parameters, four parameters, elevation fitting parameters, level grid files. All these parameters' input integrated to the interface as follow. After input the parameters, input a file name, and click on ***Save*** button , will create a "*.dam" parameter file in the "GeoPath" directory which in the "Program" folder.

Click the ***Parameter*** menu:

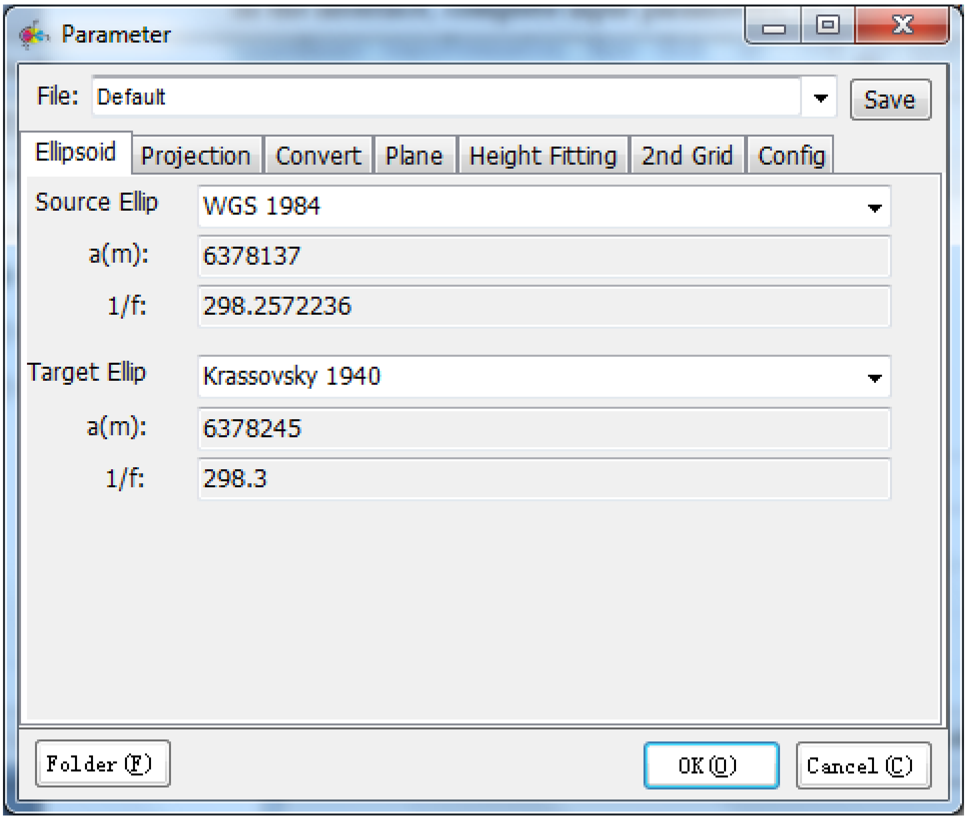


Figure 9-5

In the interface, complete inputting parameters, or click [V] drop-down button to select a file of coordinate transformation, then click on the ***Ok*** button, will get back to the main interface to positive and inverse transform coordinate:

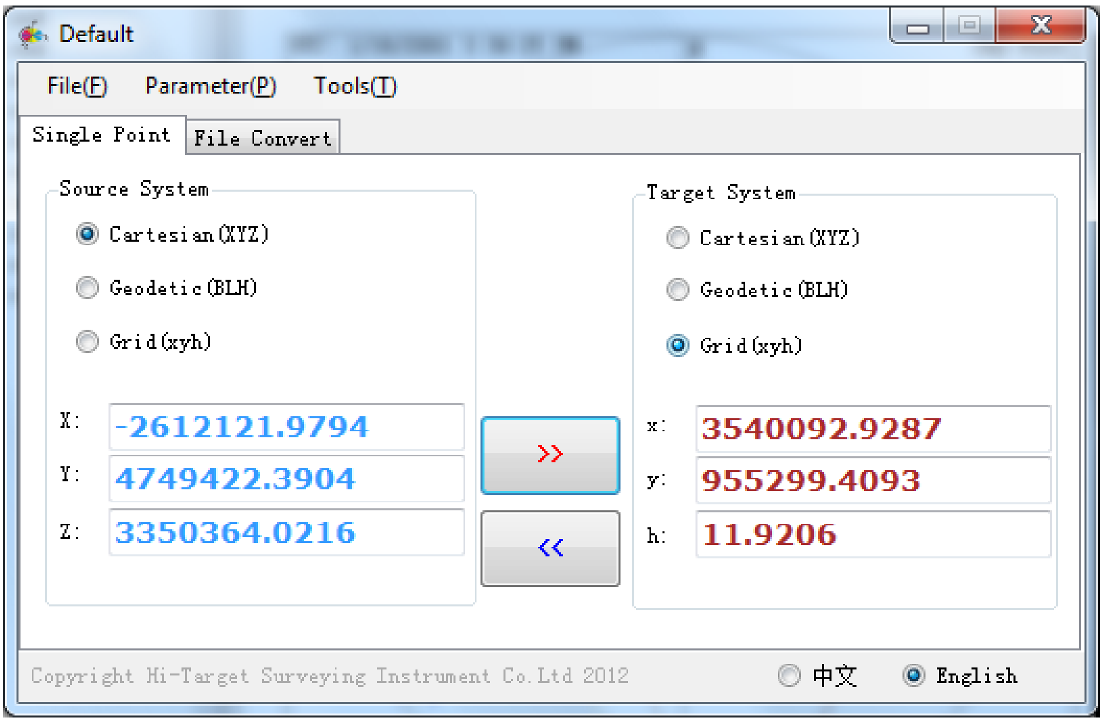


Figure 9-6

Parameter Calculation

When users have a group of control points (these points have both WGS84 coordinate and local coordinate), you can use this software to calculate the parameters. As previously mentioned, this software provides seven parameters model and four parameters and elevation fitting model solution, the calculation of two models is completed in the same interface, it's convenient to users to compare and choose different precision model. In the main interface, click the ***Parameter Clac*** in the ***Tools*** menu, can open the parameter calculation interface (if you have not input the ellipsoid and projection parameters, there will be prompted and pop-up the "Parameter" interface).

The process of parameter calculation is:

1. Input basic parameters: First, input local ellipsoid and projection parameters.

2. Import data: Add points coordinate one by one or to one data, or prepared the text file first then click the ***Open*** button (prepare note: file format is [Name, B, L, H, x, y, H]).

3. Calculate parameters: The software support two modes of coordinate transformation, click the ***Calc Bursha Parameter*** or ***Calc Helmert 2D + Height***, if use the second mode, please selected the model of elevation fitting firstly.

4. Check the result: In the result bar will show the calculated parameters, the user can copy and save them.

5. Use parameters: Click the ***Parameter settings*** button, check the transformation parameters, the ellipsoid parameters and the projection parameters. Make sure these are correct, then you can input a name and save as a "*.dam" file, this file also can be used in other Hi-target software.

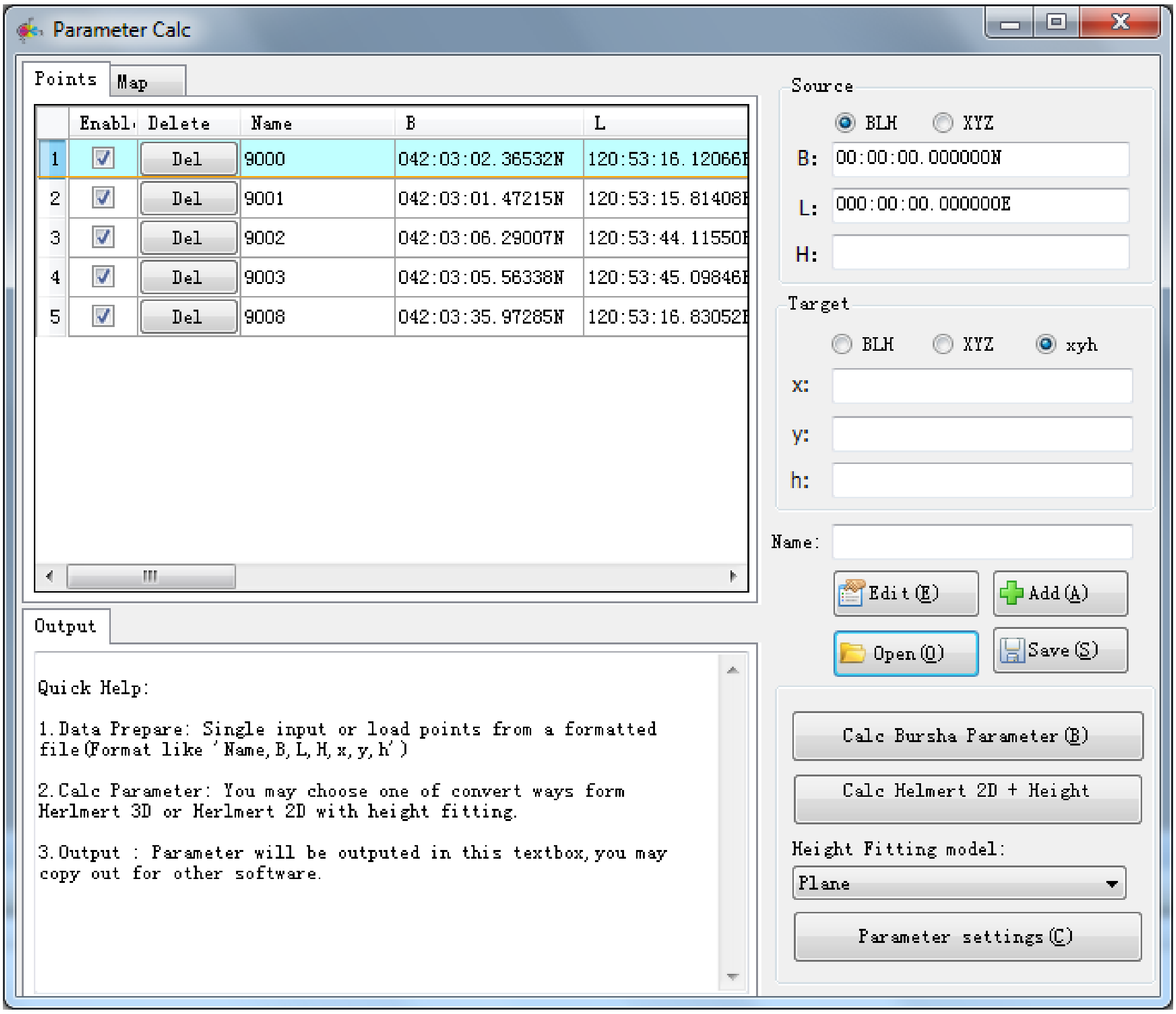


Figure 9-7

Notice: Please switch to the ***Map*** view and check the geometric distribution of the points used to calculation (Avoiding the points are presented a linear distribution, lead to the parameters has poor applicability and stability.

Satellite Prediction Software

The HGO Data Processing Software Package supplies the Satellite Prediction software. Choose ***Star Report*** in the ***Tools*** menu to function the Satellite Prediction software.

Satellite prediction is to forecast the distribution conditions of satellites at a certain time in a certain area according to the satellite almanacs data collected by receivers. So that observers can choose proper time to do fieldwork, which will make the fieldwork more effective and the data better.

The general step of this software using is as follows:

1. Update historical data;

2. Set stations' position and time, elevation angle;

3. Forecast, check the number of satellites, check the sequence chart of DOP value, choose the measuring time.

Input Almanacs Data (Yuma format)

Yuma is a kind of almanacs data format broadcast on internet by America. GPS users all over the world can download the latest almanacs data on the specific official website:

http://www.navcen.uscg.gov/ftp/GPS/almanacs/yuma/

Select ***Download Yuma (GPS)*** in the ***Help*** menu, the software will download the latest Yuma files, save it automatically and show you "download finished". See Figure9-8:

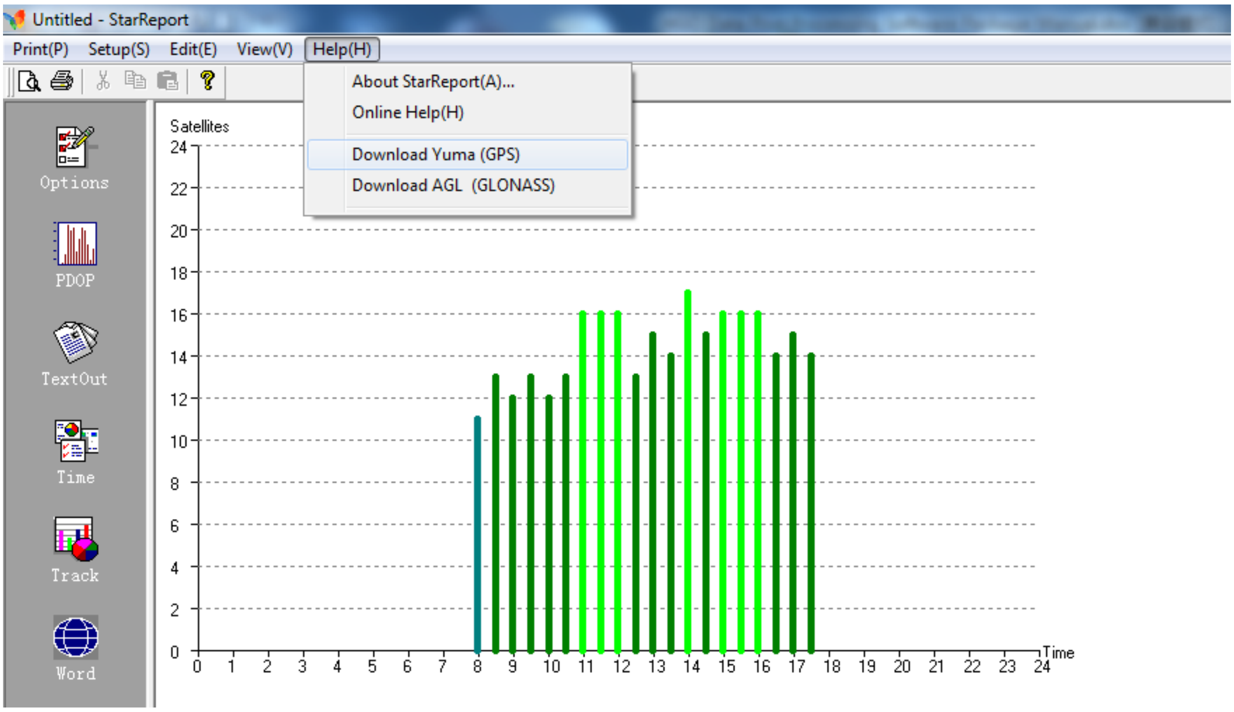


Figure 9-8

Observation Station Coordinate and Observing Period Setting

After the latest almanacs data loaded, you need to set up the station BL, height, height cutoff angle, observation period and so on, which will enable the software to calculate the parameters.

You can set up the date in ***Status*** window. The default one is the date of computer system. Users can choose any day by “reviou”, “Today”, “Next”, “Manual”. See Figure9-9:

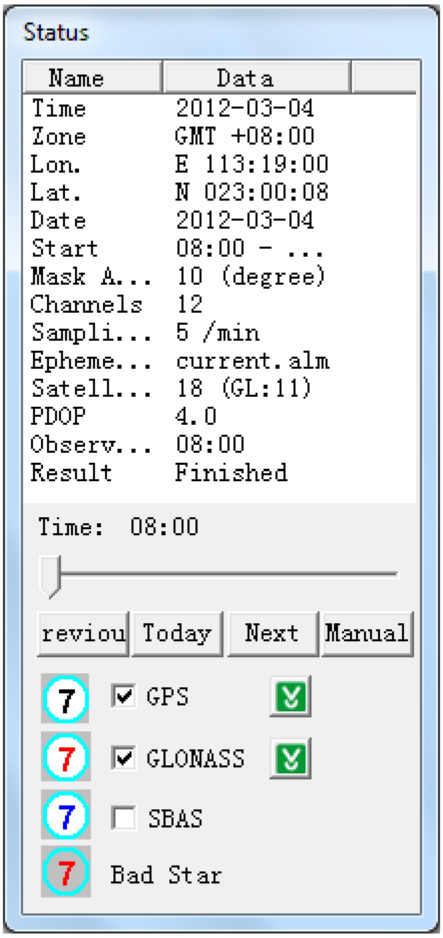


Figure 9-9

Click ***Setup*** ->***Option***··· to set up the station BL, height, elevation cutoff angle, observation period. See Figure9-10:

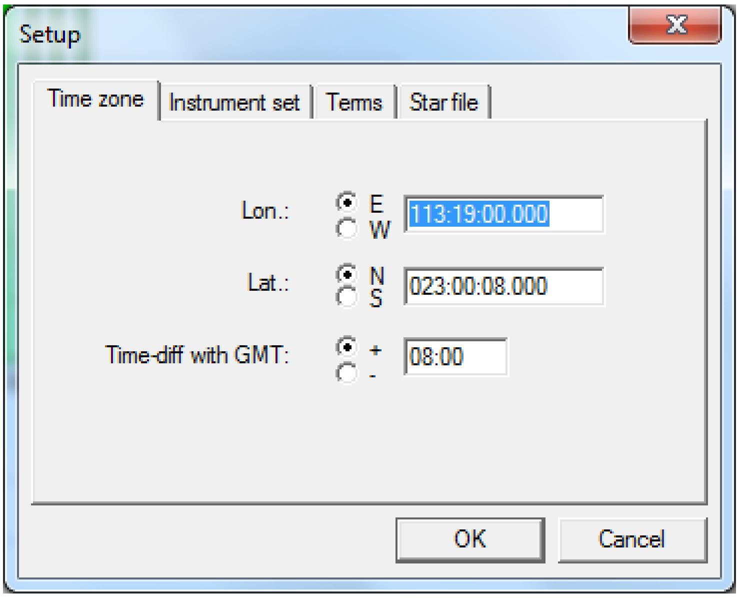


Figure 9-10

The BL coordinate need not the precise value, with 1~2 km precision will be ok. Users who do not know the BL coordinate can get it as follows:

- ✧ With attached coordinate transformation software, users can transform the XYZ of the known point to BLH and then input them into the software to do satellite prediction.
- ✧ Get the BLH format coordinate by specific GPS instruments as HD8100, HD8088, HD8800 and the like, then input the BLH into the software to do satellite prediction.

Pay more attention to the selection of the local time and GPS time when you set up the observation period. And confirm the difference between local time and UTC time when you input the observation period in ***local time*** setting. Usually the computer will suggest you to choose time zone while installing. For example, Beijing time is 8 hours ahead of the UTC time (international standard time). If none of “local time” input, the default one is Beijing time.

As usually, when setting the observation period, please make sure that the difference between the start time and the end time is several hours to 24 hours while the start time is always ahead of the end time. See Figure9-11:

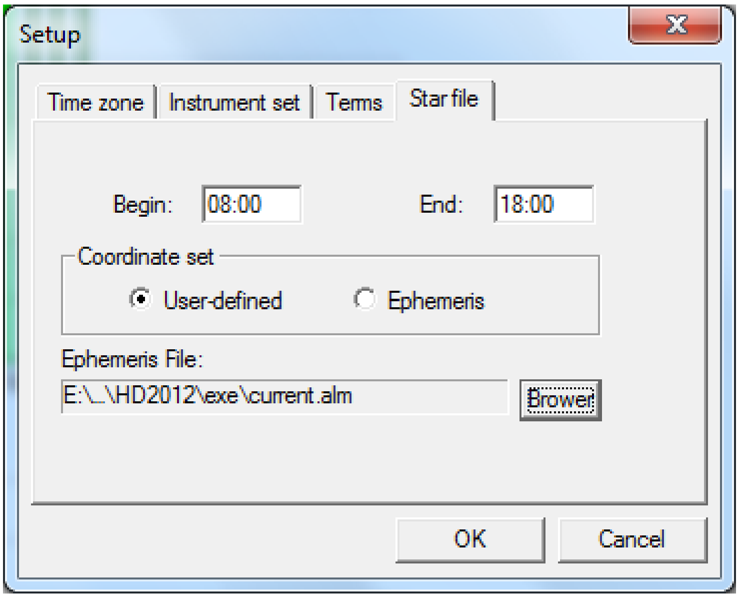


Figure 9-11

The angle will limit the azimuths of the prediction satellites in the way that only the satellites whose azimuths are over the setting one can do the prediction. Sampling rate control the data output interval. The smaller the sampling rate, the more detail the data are. See Figure9-12:

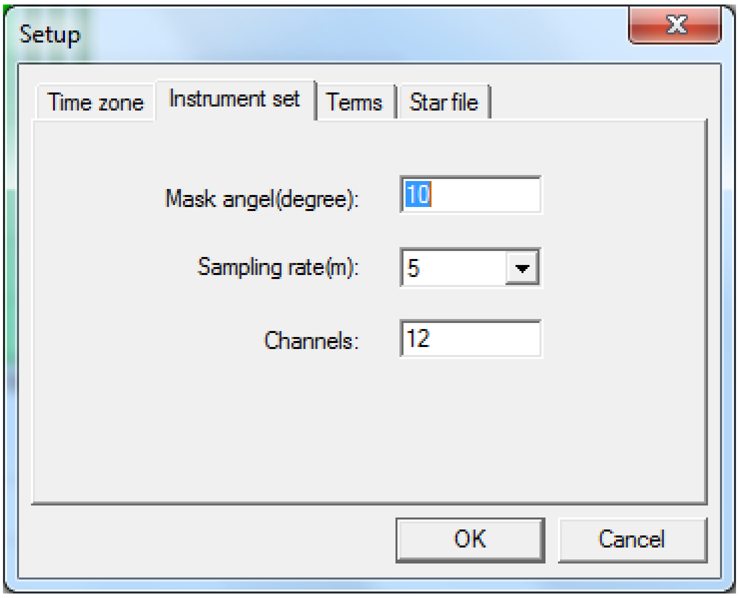


Figure 9-12

Satellite Status Prediction

After input the observation station coordinate and the observing period and the click on ***ok*** button, you can check the satellite status in any view window of the software.

1. Export satellite detailed status Click button See Figure9-13:

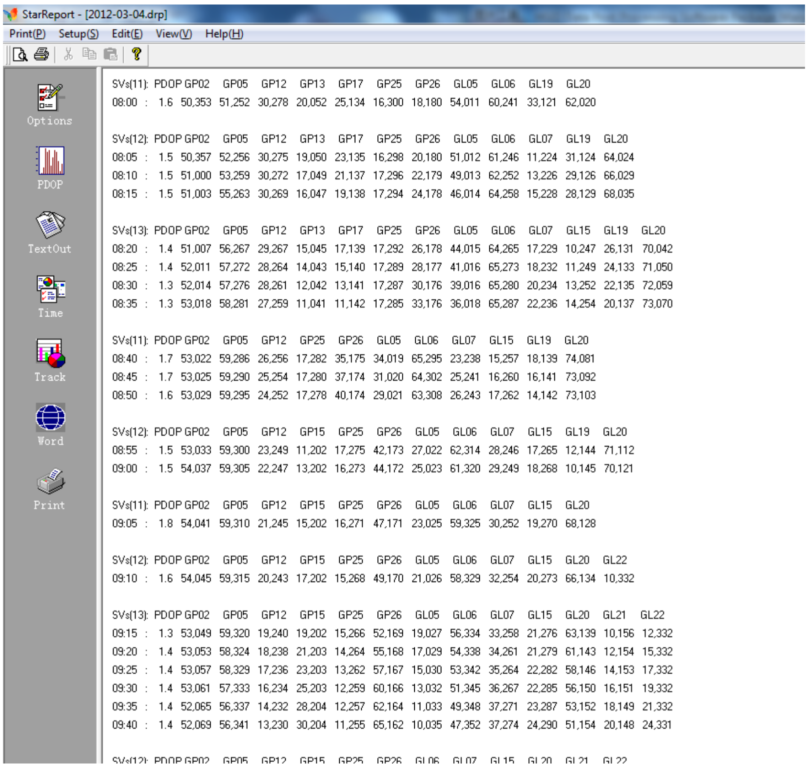


Figure 9-13

2. Satellite tracking map

Satellite tracking map shows the change of the number of the visible satellites with the time elapsing in the limited period. With the map, users can choose the period when the visible satellites are more to do observation so as to improve the fieldwork. Click button. See Figure9-14:

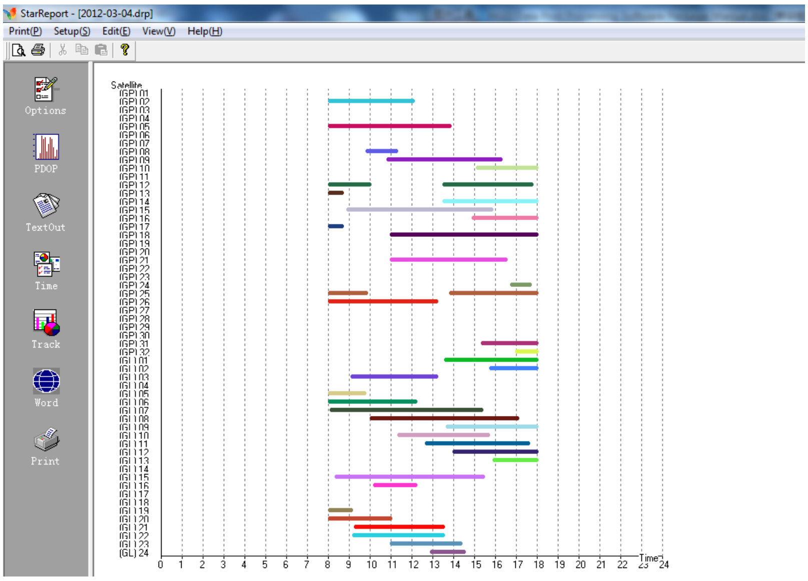


Figure 9-14

3. Constellations map

Constellations map shows the distribution conditions and the movement of satellites at a certain time in a certain area. For example, in the Figure (click), the satellite 32 will travel northwest to south in prediction. And the map shows the BL coordinate as well as the observing period.

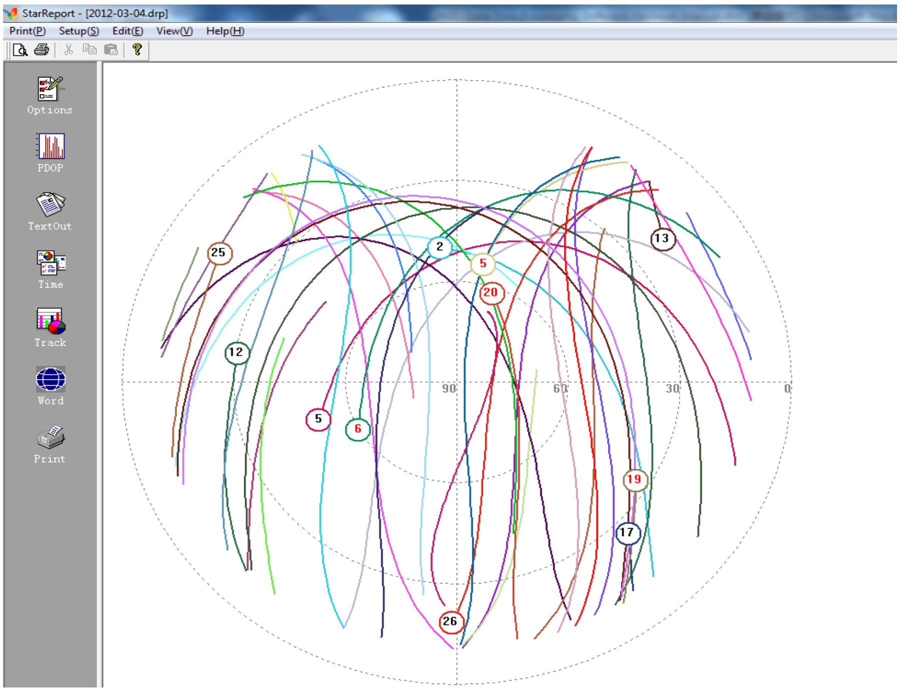


Figure 9-15

4. Number of the visible satellites and the PDOP

Click the relationship of the satellites number and the time will show in upside map while the PDOP will show in the downside map. The PDOP denotes how the positioning accuracy acts on satellites distribution. See Figure9-16:

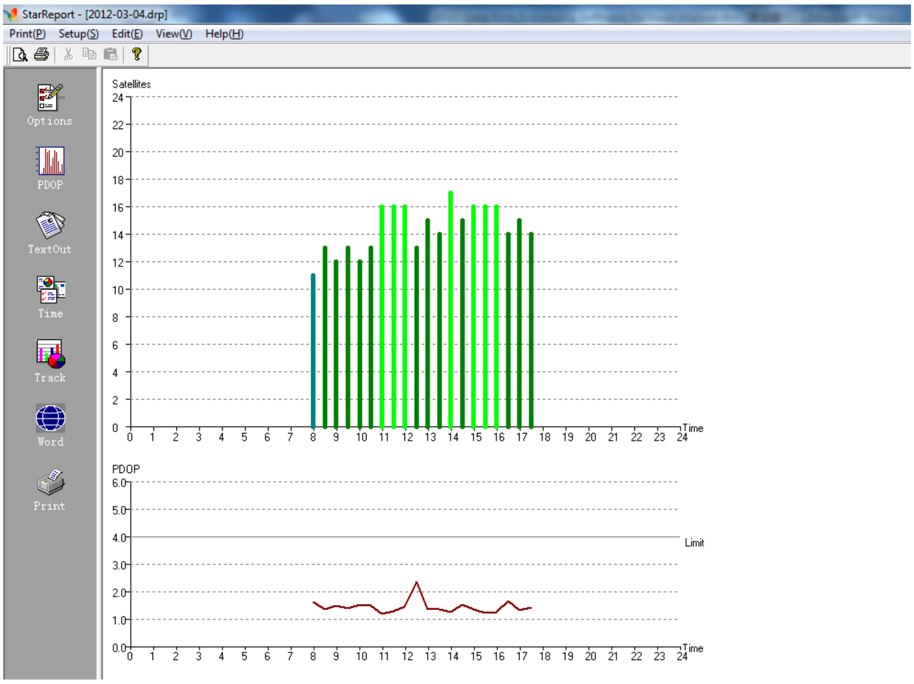


Figure 9-16

5. World map

Click , you can see the satellites traveling tracks in the world map. See Figure9-17:

Figure 9-17

6. Print out

File shows, satellite number, PDOP value and satellites distribution all can be print out.

Update Ephemeris Data

To predict satellites precisely, the ephemeris data should be updated often, suggesting no more than one month once. The inner-set of the software enable it to suggest users to update when necessary.

Precise Ephemeris Download Tool

In order to improve the precision of the static data processing software, you can download SP3 precision ephemeris data from the product FTP server which provided by the United States IGS. This tool is developed for automatic download the data rapidly and easily from the data server, is very easy to use, to select the data date and data types, click ***Start*** to download.

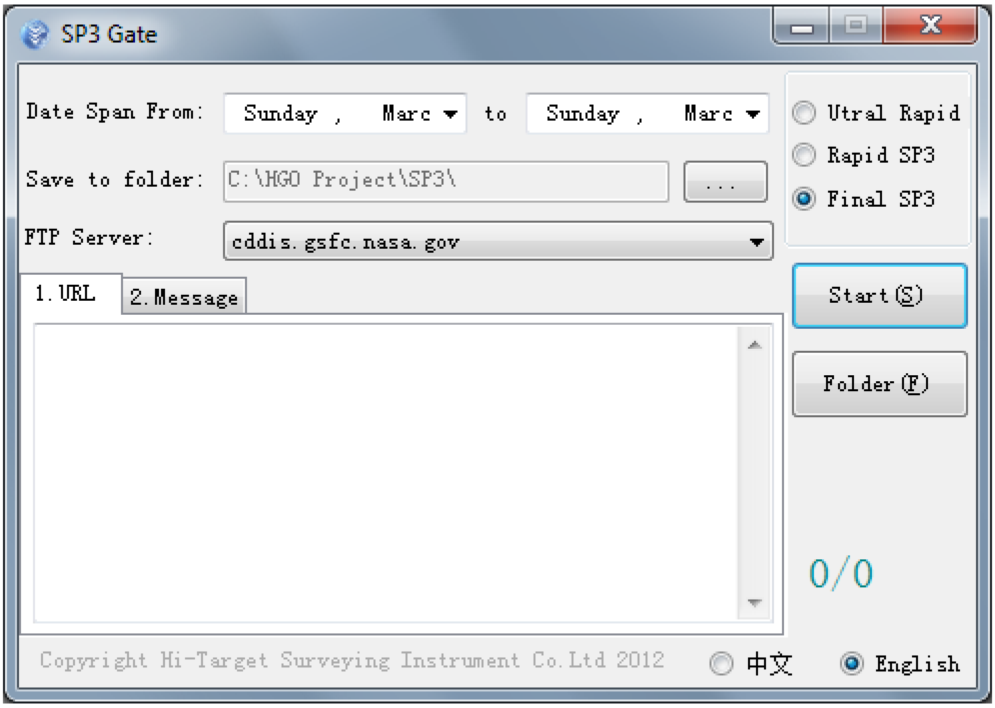


Figure 9-18

Notice: In the entire world, there are multiple FTP servers provide data download service. Please according to your network circumstance, choosing a suitable download site to download the data.